

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: H. H. KIMBALL.

VOL. XXX.

OCTOBER, 1902.

No. 10

INTRODUCTION.

The MONTHLY WEATHER REVIEW for October, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 160; West Indian service stations, 17; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Government Survey, 75; Canadian Meteorological Service, 33; Jamaica Weather Service, 130; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of

the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service; H. H. Cousins, Chemist, and in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is $157^{\circ} 30'$, or $10^{\text{h}} 30^{\text{m}}$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^{\text{h}} 36^{\text{m}} 13^{\text{s}}$ slower than seventy-fifth meridian time, corresponding to $5^{\text{h}} 36^{\text{m}}$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. R. GARRIOTT, in charge of Forecast Division.

The most important storm of the month appeared on the 6th in the Gulf of Campeachy, moved thence to the middle Gulf coast of the United States by the 10th, reached a position off the south New England coast by the morning of the 12th, and advanced over the Atlantic Ocean to a point near the north coast of Scotland by the 16th. The history of this storm previous to the 6th can not be positively determined. It is believed, however, that it originated within an area of low barometric pressure that covered the Gulf of Tehuantepec on October 3, when the barometer read 29.76 inches at Salina Cruz, a fall of .09 inch in twenty-four hours. By the morning of the 4th the low area had apparently shifted its position over the isthmus to the Gulf of Campeachy where, at Frontera, the barometer had fallen .05 in twenty-four hours and to 29.85 inches. During the 5th and 6th the barometric depression deepened over the Gulf of Campeachy and on the latter date acquired hurricane intensity and began a north-northeasterly course over the Gulf of Mexico. Inasmuch as the storms that are encountered over the extreme southern part of the Gulf of Mexico are usually straight northerly gales, or disturbances that are generated by a sweep of strong northerly winds over that region, and as there is no Weather Bureau record of a previous cyclonic development of equal intensity in the part of the Gulf of Mexico from which this disturbance advanced, the storm under consideration presents points of unusual interest. The strong northerly winds which appear to supply

one of the principal elements of storm generation over the southern part of the Gulf were not blowing from the 3d to the 6th; neither is there evidence that the storm moved westward over Yucatan from the Caribbean Sea. It may be allowable to assume, therefore, that the storm developed and intensified within the area of low barometric pressure that appeared first over the Gulf of Tehuantepec, on the Pacific coast, and later over the Gulf of Campeachy, which is the extreme southern bay of the Gulf of Mexico.

The following particulars regarding this storm, as witnessed in the Gulf of Campeachy, are furnished by Prof. A. E. Kennelly, of Harvard University:

On the 6th of October, 1902, we were laying cable from Campeachy toward Frontera de Tabasco in the steamer *Ydun*. On the 5th we had fair weather but with a marked westerly swell, for the first time in three weeks. On the 6th the weather became threatening and the glass fell slowly. The wind steadily increased from south. By 4 p. m., ship's time, the wind and sea had increased in violence to such a degree that it was necessary to cut and buoy our cable, in a position approximately latitude $19^{\circ} 30'$ north, longitude $92^{\circ} 10'$ west. The wind remained at approximately south. The gale increased in violence each hour until 3 a. m. the next morning, October 7, when the ship was evidently in the center of the hurricane with practically calm weather, but heavy sea. The barometer (aneroid) indicated 28.66 inches. Our position is not accurately known since we had drifted northward for nearly twelve hours, but it was in the center and probably about latitude $19^{\circ} 45'$ north, longitude $92^{\circ} 10'$ west. In the center of the hurricane where we had remained for two hours hundreds of birds of all kinds settled on the ship. They seemed all to be land birds, and varied in size from little reed birds to a large

stork. When daylight broke we could see that the sea was strewn with the bodies of birds that had apparently been caught in the gale ashore and had been carried out to sea. When the gale furiously recommenced at 5 a. m., it blew from the north. As the day wore on it turned slowly to the westward. We subsequently learned that the gale had passed over Frontera, and had done some damage farther south on the isthmus. The gale was over by the morning of the 8th, when the ship anchored near the Champotan Shoals.

The approach of the storm was indicated by reports from the middle Gulf coast on the morning of the 10th, and by the night of that date the center of disturbance had crossed the Gulf coast line near Mobile, Ala. At this time the storm had lost the hurricane intensity it possessed over the southern Gulf. The lowest barometer reading reported at 8 p. m. of the 10th was 29.72 inches at Mobile, and the maximum wind velocity noted on that date was 42 miles an hour at New Orleans, La. During the 11th the depression deepened, and in the evening the central pressure, 29.48 inches, appeared over southern Virginia and northern North Carolina. During the 12th the storm passed northeastward off the middle Atlantic and New England coasts with evidence of increased strength, and vessel reports show that the gales that attended its passage over the Atlantic were of unusual violence. Morning reports of the 15th from the British Isles showed 24-hour pressure falls of one-half to three-quarters of an inch on the west and north coasts. On the morning of the 16th pressures were below 29.00 inches at stations in the north of Scotland, and the presence of a storm center slightly to the southward of the Orkney Islands was indicated. From this position the disturbance passed eastward over the North Sea.

Ample and timely warnings were issued to all United States ports regarding the course and character of this storm.

A disturbance that appeared over the east part of the Gulf of Mexico on the 25th moved northeastward along the Atlantic coast to New England, where it deepened and caused high winds on the 28th.

On the Great Lakes the severest storm of the month occurred on the 12th and 13th. This storm first appeared as a shallow depression over the central valleys of California on the 10th. During the 10th and 11th the depression moved eastward to the middle Rocky Mountain region and during the 12th it deepened rapidly and passed north of east to eastern Iowa. By the morning of the 13th the center of disturbance had reached the northern part of Lake Huron, with minimum reported barometer 29.22 inches at Alpena, Mich., and wind velocities of 56 miles an hour at Chicago, Ill., and 42 miles an hour at Cleveland, Ohio, and Buffalo, N. Y. During the succeeding 24 hours the storm advanced over the St. Lawrence Valley with maximum wind velocity of 60 miles an hour at Buffalo, N. Y. Vessel interests were fully advised of the approach of the storms referred to.

On the Pacific coast the severest storm of the month occurred on the north coast on the 27th. Storm warnings were hoisted on the Washington coast the morning of the 27th and the wind increased to gale force in the afternoon without, however, causing any damage to shipping.

The most important frosts of the month occurred from the 14th to 16th and from the 28th to the 31st. On the 14th frost was reported in the lower Missouri Valley and in the Mississippi Valley as far south as northern Arkansas. On the morning of the 15th frost was noted generally from the Ohio Valley to central portions of the middle and east Gulf States. On the 16th frost occurred from the central parts of the east Gulf States over the interior of the South Atlantic States. On the morning of the 28th frost was observed in the Middle-western States. By the 29th the frost area had extended over the interior of the middle and east Gulf and South Atlantic States. On the 30th frost occurred in the interior of the east Gulf and South Atlantic States and thence to the North Carolina coast. Frost was also reported on the 31st generally over North Caro-

lina. In regions where crops were subject to damage by frost, warnings were distributed on the days preceding its occurrence.

In California rain warnings were of value to fruit dryers and raisin makers.

At the close of the month there was evidence of a disturbance south of eastern Cuba. This disturbance moved north-eastward over Santo Domingo and the Atlantic Ocean during the early days of November, 1902, and will be discussed in the MONTHLY WEATHER REVIEW for that month.

BOSTON FORECAST DISTRICT.

The storm of the 28th was quite severe along the northern coast, the wind being from east and southeast, and shipping was delayed and some damage resulted. Warnings were displayed well in advance of the storm. The first killing frost of the season occurred on the 22d, and was announced twenty-four hours in advance. Considerable benefit was derived from the warnings.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Storm warnings were issued for the Louisiana and Mississippi coasts on the 10th and 22d, and both were fully justified. Two vessels were lost in the storm of the 22d. The steamer *Palor City* sunk in the river as a result of the steamer *Natchez* being blown against her. A three-masted schooner, the *La Plata*, went aground on the Chandeleur Islands, Miss. Frost, for which warnings were issued, occurred in Arkansas on the 14th, 28th, and 29th.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

The stormy season which set in earlier than usual during September continued through the month of October, with increasing severity. It is probable that the daily forecasts and storm warnings were of great benefit to marine interests, as no important casualties have been reported.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

With the exception of a frost warning sent to a few points in the extreme southeastern part of Colorado on the morning of the 3d, no special warnings were issued.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

Rain warnings were issued to fruit dryers and raisin makers throughout the State, and at nearly all points trays were stacked before the rains began. Storm warnings were displayed on the northern California coast on the 21st and 22d. Incoming mariners reported severe weather outside on those dates.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

Frost forecasts were discontinued after the season of danger to crops had passed. Storm warnings were ordered for three disturbances, the most severe of which occurred on the 27th. *E. A. Beals, Forecast Official.*

RIVERS AND FLOODS.

The usual autumnal quiet of the rivers was not disturbed during October except in the Middle and South Atlantic States where there were occasional interruptions of limited duration and extent, caused by the heavy rains that are the almost invariable accompaniments of storms of the southwestern and Gulf of Mexico types. The first was a moderate flood in the James and Roanoke rivers from the 6th to the 8th, inclusive, the result of heavy rains over southern, and particularly over

southwestern Virginia, from a storm of the southwestern type. The rains also extended over the headwaters of the South Carolina rivers, causing rapid though not alarming rises, which were repeated in a lesser degree after the Gulf storms of the 11th and 27th. The latter storm also occasioned the rise of the 29th and 30th in the north branch of the Susquehanna River, but the crests reached were several feet below the danger lines.

The danger line was reached on the 6th at Richmond, Va., and exceeded by over five feet on the 8th at Weldon, N. C. At the former place the water reached the steamship docks, necessitating the removal of a large amount of freight. Much other property along the river front was also removed to places of safety. The usual Weather Bureau warnings of the approaching flood were issued in ample time to permit this work to be done effectively and without undue haste. The Roanoke flood apparently caused no damage worthy of mention.

The rivers to the westward changed but little, although the mean stages in the Ohio were somewhat higher than during September. The suspension of through navigation between Cincinnati and Pittsburg continued, although local traffic for light draught boats was possible between intermediate points the greater portion of the month. River traffic on the Alabama River above Selma, Ala., was suspended on the 26th on account of the extremely low stage of the river, and again at Chattanooga, Tenn., on the 6th. It was resumed at the latter place on the 14th, but was again suspended on the 18th.

The highest and lowest water, mean stage, and monthly range at 143 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on

the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—H. C. Frankenfield, Forecast Official.

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.	30, p. m.	47	122	5, a. m.	45	64	3,350	4.5	744	31.0
II.	1, p. m.	51	120	9, p. m.	37	76	2,800	3.5	800	33.3
III.	8, a. m.	43	109	11, a. m.	42	70	1,900	3.0	543	22.6
IV.	13, a. m.	41	101	15, p. m.	35	82	1,150	2.5	460	19.2
V.	15, a. m.	47	101	18, p. m.	46	60	1,825	3.5	521	21.7
VI.	17, p. m.	48	125	22, a. m.	42	72	3,400	4.5	756	31.5
VII.	25, a. m.	45	117	30, p. m.	35	76	2,750	5.5	500	20.8
Sums.							19,075	30.5	4,957	206.5
Mean of 8 paths.							2,384		620	25.8
Mean of 30.5 days.									625	26.0
Low areas.										
I.	2, p. m.	27	97	6, p. m.	48	68	2,350	4.0	588	24.5
II.	10, a. m.	29	88	13, a. m.	47	54	2,300	3.0	767	32.0
III.	10, p. m.	33	115	14, p. m.	46	60	3,150	4.0	788	32.8
IV.	13, a. m.	34	114	15, p. m.	48	68	2,200	2.5	880	36.7
V.	17, p. m.	37	100	19, a. m.	30	95	775	1.5	517	21.5
VI.	21, p. m.	51	120	25, a. m.	47	65	2,700	3.5	771	32.1
VII.	24, a. m.	41	112	26, p. m.	45	84	1,850	2.5	740	30.8
VIII.	25, p. m.	27	83	29, p. m.	46	60	1,850	4.0	462	19.2
Sums.							17,175	25.0	5,513	229.6
Mean of 8 paths.							2,147		689	28.7
Mean of 25.0 days.									687	28.6

* September.

For graphic presentation of the movements of these highs and lows see Charts I and II.—Geo. E. Hunt, Chief Clerk Forecast Division.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

Alabama.—Rainfall slightly above average, being decidedly excessive in a few eastern counties; frost of last few days proved damaging over northern half of State; some cotton damaged by rain; conditions generally favorable for maturing late minor crops.—F. P. Chaffee.

Arizona.—The month was generally warm, with brief periods of cool weather. Except at a few stations, the weather was dry and unfavorable for fall seeding. There is very little feed on the ranges.—M. E. Blystone.

Arkansas.—Cloudy, damp, and rainy weather during the first week caused much cotton to rot and sprout in the bolls and greatly delayed picking. During the remainder of the month the weather was favorable for gathering crops and caused some improvement in cotton; picking and ginning progressed rapidly and cotton was marketed almost as fast as ginned. The yield of corn was generally good. Sowing of wheat progressed rapidly and considerable had come up to good stands at the close of the month.—Edward B. Richards.

California.—Nearly normal weather conditions prevailed throughout the State, and the late crops were mostly under shelter before the heavy rains at the close of the month. Late grapes on the vines were considerably injured, but raisins and deciduous fruits on the trays were not materially damaged, as ample warnings were given. The first carload of oranges was shipped from Porterville on the 31st.—Alexander G. McAdee.

Colorado.—Conditions were exceptionally favorable to the ripening of late fruits. While precipitation on the eastern slope interfered materially with the digging of beets and late potatoes, it put the soil in fine condition for plowing and seeding. Wheat and rye, as a rule, germinated well. The yield of sugar beets is below the average; digging progressed very favorably during the latter half of the month, but at its close one-half of the crop was still in the ground.—F. H. Brandenburg.

Florida.—The first decade was generally favorable for harvesting cotton and corn. The second and third decades gave too much rain in some sections for vegetables on low lands. Sweet potatoes improved and the crop will be larger than expected. Oranges advanced toward maturity, and a good lot was disposed of; the fruit, however, was far from being in prime condition. The condition of citrus trees, pineapples, and vegetables is very satisfactory.—A. J. Mitchell.

Georgia.—Temperature averaged about normal, but much higher than

October, 1901. The rainfall was unevenly distributed, being very heavy in some southeastern counties. Light frosts in northern and middle counties on 15th and 16th; light to heavy frosts, except in extreme south on 29th and 30th. Relatively little seeding done, ground too hard and dry to plow. Cotton picking practically completed. Yields of sweet and Irish potatoes and cane excellent.—J. B. Marbury.

Idaho.—There were no general storms during the month. This resulted in the largest deficiency of precipitation of any October since 1895. The weather conditions were favorable for harvesting late apples and vegetable crops, but fall plowing and wheat seeding were delayed. Stock on the range suffered in consequence of short grass and drinking water, incident to the light rainfall. In many agricultural sections vegetable crops attained to full maturity before the arrival of a frost sufficiently heavy to kill.—S. M. Blandford.

Illinois.—The greater part of the month was warm, but on the 13th and 14th in the northern portion and on the 29th in the southern, freezing temperatures occurred. The rainfall was sufficient and well distributed in the northern and central districts, but was deficient in the southern. Corn matured rapidly and was generally being cribbed in good condition. Seeding of wheat and rye made rapid progress. Early sown wheat was making good growth, though dry conditions and the hessian fly combined to retard its growth in the southern districts. Pastures were everywhere good.—Leon J. Guthrie.

Indiana.—First decade of month showery, with temperature slightly below normal. Corn dried slowly, some damaged in shock. Threshing clover delayed and some seed lost. Fall plowing and planting retarded. Balance of month temperature above normal and weather comparatively dry. Fall seeding practically completed. Wheat up to a good stand, but early planted was damaged by flies. Corn dried and cribbing commenced. Pastures good. Hog cholera prevalent in some localities; most stock in fine condition.—W. T. Blythe.

Iowa.—The month was favorable for farm work and drying the corn crop, except in portions of central and southern section, where rainfall was excessive. Corn gathering in progress, with more than the usual amount fit only for immediate feeding. Considerable progress in plowing. Fall pasturage extra good. Potato crop fair, and apples better than early reports indicated.—John R. Sage.

Kansas.—The first week was wet and cool, the rest of the month the weather was very favorable. Much wheat was sown after the 10th. Early sown wheat is up, in fine condition, good stand, and growing. Corn husking progressed rapidly, good quality and quantity. Apples gathered, crop fine. Some second growth cane cut for hay in south. Fall seeding of alfalfa and English blue grass successful in north.—*T. B. Jennings.*

Kentucky.—Weather was quite favorable to farming. An average acreage of wheat sown, and most of it has made good growth. Fly has attacked a few of the earliest fields. Rye and oats have made a good start. Corn gathering progressed rapidly; the yield is nearly an average one. Tobacco cured in fine condition; good color and free from wormholes; stripping has begun. Pastures in good condition and stock thriving. Good crops of late forage plants saved.—*S. P. Gresham.*

Louisiana.—General rains on 3d and 4th, accompanied by high winds, interfered with cotton picking and damaged the crop. Much cotton was blown out of the bolls and beaten into the dirt; seed sprouted in the bolls in many of the northern and central parishes. During the remainder of the month exceptionally favorable weather prevailed and picking was nearly completed at the close of the month. While the yield is better in some localities than was anticipated, and is about the average in a few sections, it is generally much below the average and in many places is not much more than half a crop. Sugar cane made satisfactory growth; grinding is progressing satisfactorily; the yield of sugar is improving under favorable weather conditions. Harvesting and thrashing of rice were about completed during the month; the yield has not been satisfactory. The bulk of the corn crop has been housed; the yield is very light.—*J. M. Cline.*

Maryland and Delaware.—Several periods of heavy rain delayed seeding and damaged some corn, fodder, and late tobacco, but prevailing mild temperatures and much open weather favored farm work at other times. Wheat nearly all sown, with good stands in early fields, but slow germination in late fields. Considerable corn cribbed; yields ordinary to good, but many ears soft. Tomato packing closed about the 20th, after a satisfactory season. Grasses grew nicely. Winter apples scarce.—*Oliver L. Fussig.*

Michigan.—The first half of the month was cool and showery, delaying the maturity of sugar beets and rotting many late potatoes. The showers also had the effect of delaying the beet harvest and the delivery of sugar beets to the factories. The last half of the month was drier, warmer, and more favorable for field work. The corn crop is small and poorly matured. Sugar beets are yielding well. Winter wheat and rye are mostly sown and germinating finely.—*C. F. Schneider.*

Minnesota.—The weather was dry early in the month and showery in the latter half. Thrashing progressed well during the dry period, though many stacks were damp. Plowing delayed by the slowness with which crops were taken from the fields, by scarcity of help, and in some southern portions by the wetness of the lowlands. Corn is in very poor condition and not much is fit for cribbing or seed. Winter wheat and rye look well.—*T. S. Outram.*

Mississippi.—The cool and wet weather of the first decade proved damaging to cotton, rotting and sprouting being prevalent in low lands; the balance of the month was favorable with the exception of frost in north portion on the 29th, which killed the top crop; late cotton matured rapidly in west and north portions, where picking continued with average yield in many counties; elsewhere picking was about completed with light yield. Minor crops were generally making from fair to good yields.—*W. S. Belden.*

Missouri.—With the exception of the first five days the month was unusually pleasant. Corn dried out well, and the damage resulting from the previous wet weather was comparatively slight, except in a few localities. Wheat sowing was completed during the middle and latter part of the month and good stands were reported, as a rule, but in the central and southern sections there was much complaint of fly in the early sown.—*A. E. Hackett.*

Montana.—The month was characterized by moderate temperature, a high percentage of sunshine and a very considerable deficiency in precipitation. At the majority of stations the monthly maximum occurred between the 2d and 7th, while the monthly minimum was most generally recorded during the last decade of the month. At a large number of stations the amount of precipitation recorded was the least for any October since the commencement of observations. Considerable fall plowing done.—*Montrose W. Hayes.*

Nebraska.—The heavy rains the first half of the month greatly retarded farm work and caused some damage to crops in field and stack. Thrashing progressed rapidly the last half of the month. Wheat seeding was delayed by the wet weather, and most of the seed was placed in the ground later than usual, a large amount being sown the last two weeks of October. Early sown wheat came up well and is growing finely. Corn dried out slowly and generally very little husking was done until the last days of the month.—*G. A. Loveland.*

Nevada.—The weather of the month was remarkably pleasant, there being an average of twenty clear days. The conditions were very favorable to harvest operations and farm work generally. Crops harvested in excellent condition; little or no damage from frost.—*J. H. Smith.*

New England.—The weather of the month was favorable to farm opera-

tions, harvesting crops, and to seeding and germination of seeds. The temperature was generally above normal and the precipitation decidedly above the average. Severe local storms occurred in Vermont on the 18th, with thunderstorms, hail, and high winds. The first general killing frost, one to reach all sections, occurred on the 22d, but caused little damage, as crops had been secured.—*J. W. Smith.*

New Jersey.—The weather conditions were unfavorable for farming operations during the first half of the month; frequent heavy rains prevented seeding of wheat and rye; latter half more favorable, seeding completed; early sown has obtained a good stand and the late sown coming up evenly; corn nearly all husked, yield good in central and southern but only fair in northern sections; pastures excellent. First killing frost occurred on the 22d; late crops all housed before that date.—*Edward W. McGann.*

New Mexico.—Warm, clear, and dry month. Absence of general killing frosts permitted grass on the ranges to cure exceptionally well, but on northern ranges there was little to cure. Number of stock greatly reduced on northern ranges for the winter owing to scarcity of feed.—*R. M. Hardinge.*

New York.—The weather during October was generally favorable for farm work and for wheat and rye, which were in good condition at the close of month, the early sown being excellent and the late good, but not so well advanced. Pastures and fall feed were good, but corn, beans, potatoes, apples, and grapes were much below the average, both as to quantity and quality, but all crops were harvested without material damage by frosts.—*R. G. Allen.*

North Carolina.—Conditions during the month were very favorable for farm work. Gathering crops was well advanced. Tobacco was all cut and safely housed. Corn, peanuts, rice, and hay were harvested. Plowing and seeding winter grains made rapid progress. Early sown winter wheat and oats came up to good stands and were thrifty and vigorous at the close of the month. Cotton continued to develop and the yield was increased until stopped by heavy frost on 30th. Picking was finished, except in scattered localities.—*C. F. von Herrmann.*

North Dakota.—The weather during the month was generally favorable for farm work, although thrashing and fall plowing were all that remained to be done. Thrashing was occasionally interrupted by light rains, which were not heavy enough, as a rule, to wet the ground sufficiently to make fall plowing easy, except in a few favored sections in the Red River Valley.—*B. H. Bronson.*

Ohio.—Corn, tobacco, and clover seed damaged by wet weather during first of month. There is considerable soft corn. Tobacco curing well. Wheat seeding well advanced; germinating well; stand generally good; fly is reported in some central and western counties. Pasture and grass fields good. Potato crop good. Apples yielding better than expected in north and east.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Fair weather, excess in temperature, and scattered showers favored progress of farm work and growth of cereals in the ground. Late wheat was planted and came up to a good stand; early sown wheat was high enough to pasture. Cotton opened and gave larger yields than was expected, while the fibre and quality were good. Corn husking gave fair to good yields. June corn, late potatoes, and turnips made good growth. Grass, pastures, and stock were in good condition. Fruit trees were in good condition for winter.—*Chas. A. Hyle.*

Oregon.—There was not rain enough until the last decade of the month to soften the soil for fall plowing and seeding, and, consequently, this work was started later than usual. Early sown grain or summer fallowed land germinated slowly, and at the end of the month the fields were spotted and uneven in most places. Some few sections report a poor crop of winter apples, but, taking the State as a whole, the crop promises to be very satisfactory.—*Edward A. Beals.*

Pennsylvania.—Heavy precipitation damaged corn and buckwheat in many sections and retarded husking, thrashing, and late seeding. Early sown wheat and rye made favorable advancement. Corn, potatoes, and buckwheat gave satisfactory returns generally, but complaints of corn falling to mature and potatoes rotting were numerous. The apple crop was better than early conditions and continued unfavorable weather gave reason to expect.—*T. F. Townsend.*

Porto Rico.—Rainfall was insufficient for all agricultural interests excepting that of coffee. Cultivation of young crops and the preparation of lands for new crops have been carried on under considerable difficulty because of the dry condition of the ground. Coffee berries began to mature very rapidly early in the month and the growers have been greatly taxed to gather them as fast as they ripened. Fortunately the crop has been pretty well saved with but little loss. Young canes have maintained a good color but have not made the usual advancement. Old canes have arrowed quite freely. Tobacco interests are in a highly satisfactory condition; large amount of seed has been sown, which has germinated rapidly, the young plants are fast becoming established, and the lands are well prepared for the young plants. Markets were well supplied with small crops, ground provisions, vegetables, and fruits of the season.—*E. C. Thompson.*

South Carolina.—Although the precipitation was in excess of the normal, it was so well distributed throughout the month that opportunity was given for gathering corn and cotton, making hay, and finishing rice

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest

and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, October, 1902.

Section.	Temperature—in degrees Fahrenheit.						Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.				Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.	Station.	Amount.	Station.	Amount.
Alabama	63.4	-0.4	Pushmataha	95	3	Hamilton	26	29	Union Springs	8.65	Riverton	1.39
Arizona	67.4	+1.8	Aztec	101	15	Flagstaff	21	3, 5, 29	Tucson	1.64	17 stations	0.00
Arkansas	62.5	-0.2	Arkadelphia	90	9	Pond	29	28	New Gascony	7.10	Mount Nebo	0.88
California	60.7	-0.3	Rison	26	26	Pocahontas	29	29				
Colorado	48.5	+1.1	Ogilby	104	6	Bodie	-6	25	Fort Ross	8.95	11 stations	0.00
Florida	74.2	+1.0	Blaine	90	21	Russell	0	4, 15	Ruby	2.57	Montrose	0.10
Georgia	61.4	+0.7	Cheyenne Wells	22	22							
Idaho	49.2	+1.6	Wausau	96	1	Wausau	33	30	Hypoluxo	18.99	Holt	0.98
Illinois	57.0	+1.9	Fitzgerald	92	2	Clayton, Tallapoosa	28	29	Valona	14.27	Lost Mountain	0.92
Indiana	56.7	+1.3	Millen	3	3							
Iowa	53.5	+3.3	Silver City	91	18	Forney	12	30	Silver City	1.44	Downey	0.01
Kansas	58.8	+2.1	Centralia	93	9	Tiskilwa	23	14	Cambridge	4.19	Mount Vernon	0.28
Kentucky	60.1	+1.2	Madison	89	9	Hallidayboro	29	29	Fort Wayne	4.28	Elkhart	0.70
Louisiana	67.3	-0.4	Ida Grove	83	10	La Fayette	24	29				
Maryland and Delaware	57.3	+1.7	Council Bluffs	94	23	Plover	20	14	Newton	6.66	Sioux Center	0.28
Michigan	48.3	-0.9	Hutchinson	94	23	Wallace	20	27	Hanover	4.00	Independence	0.82
Minnesota	47.1	+0.5	Williamsburg	91	9	Achilles	25	29				
Mississippi	64.4	0.0	Alexandria	93	7	3 stations	25	29	Earlington	3.74	Fords Ferry	T.
Missouri	59.4	+2.1	Boettcherville, Md.	89	25	N. La. Ex. Station	34	29	Port Eads	9.11	Wallace	0.99
Montana	46.6	+1.7	Wasopi	81	24	Deepark, Md.	17	30	Bachmans Val., Md.	10.72	Pocomoke City, Md.	2.05
Nebraska	53.6	+2.9	Currie	80	24	Ewen	16	9	Hagar	6.19	Ludington	0.30
Nevada	49.8	+0.8	Jackson	91	2	Angus	11	13	Pine River Dam	5.35	Worthington	0.14
New England	49.4	+1.3	Lebanon	88	22	Pittsboro	28	29	Bay St. Louis	7.65	Water Valley	T.
New Jersey	56.0	+2.1	Glendive	85	5, 7	Duck Hill	30	30				
New Mexico	53.5	+0.8	Loup	95	9	Potosi	23	29	Oregon	4.72	Jackson	0.87
New York	49.1	+0.3	Kennedy	97	17	Boulder	14	30	Fort Logan	0.90	4 stations	T.
North Carolina	61.3	+1.5	Rioville	97	17	Lynch	14	28	Bradshaw	5.15	Hartington	T.
North Dakota	43.7	+1.7	Melville, R. I.	79	2	Monitor Mill	13	31				
Ohio	54.6	+1.8	4 stations	80	9, 25	Patten, Me.	14	24	Lewers Ranch	1.71	6 stations	0.00
Oklahoma and Indian Territories	62.9	-0.1	Carlsbad	100	23	Layton	20	22	Rutland, Mass.	8.67	Cornwall, Vt.	2.64
Oregon	53.2	+1.6	Liberty	79	19	Winners	15	27	Hightstown	9.35	Cape May City	3.82
Pennsylvania	53.1	+0.9	S. Canisteo, W. Berne	88	1, 8, 9, 13, 20	Indian Lake	12	18	Fort Stanton	1.81	Galistoe, Raton	0.00
Porto Rico	78.2	-0.6							Setauket	7.32	South Canistoe	1.49
South Carolina	63.2	-0.8										
South Dakota	49.9	+1.8										
Tennessee	60.3	+1.1										
Texas	68.1	0.0										
Utah	50.0	+1.0										
Virginia	58.8	+0.8										
Washington	52.4	-1.8										
West Virginia	56.5	+1.6										
Wisconsin	49.5	+0.8										
Wyoming	45.8	+1.0										

harvest. The frosts were generally light and damaged the most tender vegetation only. Lands were prepared and much oats sown as well as some wheat; the stand of oats is good. Sweet potatoes and peas gave fine yields.—*J. W. Bauer.*

South Dakota.—The weather was generally favorable for field operations, for drying outstanding corn, and for the germination and healthy growth of winter rye. Plowing was in some localities retarded by insufficient moisture. Corn pulling advanced fairly well, but as a result of September frosts, there was considerable still too soft for cribbing, some was spoiling, and the marketable proportion was less than indicated September 30. Thrashing of grain and potato digging were practically completed.—*S. W. Glenn.*

Tennessee.—There were light rains at intervals, with heavy frosts about the middle of the month. Work progressed rapidly and favorably, except during rains on the 3d and 11th; wheat land was mostly seeded under favorable conditions, early wheat being thrifty and seeding showing good stands; cotton much injured by rains, the crop mostly gathered and below average; late corn developed better than expected; late tobacco made fine growth, crop all housed; at the close of the month fall work was well advanced.—*H. C. Bate.*

Texas.—General rains during the month of September and the early part of the current month placed the soil in excellent condition for plant growth and the seeding of grain. Thermal conditions were unusually favorable for maturing and gathering crops and there was an entire absence, except in the extreme western portion, of frosts injurious to vegetation. Cotton picking progressed very favorable during the month

and at its close picking was completed, except in fields of late cotton and in sections where the top crop was opening. Some complaint was made of cotton not opening satisfactorily because of dense foliage and excess of sap in the bolls. Considerable damage to rice was done by the heavy rains of September and the early part of October. The seeding of wheat, rye, oats, and barley made very satisfactory progress and these crops at the close of the month were generally up to fine stands and growing nicely. Preparations for fall and winter vegetables well advanced.—*Edward H. Bowie.*

Utah.—The ground was generally too dry for plowing and very little of this was done. The dry, mild weather was very favorable for other kinds of farm work. Potatoes were harvested, but sugar-beet digging was still in progress at the close of the month. The ranges are in very poor condition in all parts of the State and stock will suffer from shortage of feed during the coming winter.—*L. H. Murdock.*

Virginia.—The month was generally favorable for fall work. The seeding of winter wheat and oats was practically completed and of that sown early many fields came up to good stands. Fall grass did nicely and late pastures afforded excellent grazing. The work of cutting and housing tobacco was completed early in the month and the gathering of corn was finished by its close. Plowing and other soil preparations for late seeding are about done.—*Edward A. Evans.*

Washington.—A warm and unusually dry month. The first half of the month was very favorable for plowing and sowing fall wheat, owing to the copious rains during last week of September. The last three weeks

were too dry for germination of wheat in the drier parts of the eastern counties.—*G. N. Salisbury.*

West Virginia.—Fall plowing was rapidly pushed during the first week and seeding was mostly done. Wheat, rye, and oats germinated quickly under the warm sunshine, and were looking green and thrifty at the close of the month. Later sown grain did not germinate so well for lack of moisture. Corn hardened nicely and some was husked. Cabbages and turnips turned out better than expected. Pastures were short, but stock was in good condition; apples were mostly picked, but the yield was light and of inferior quality.—*E. C. Vose.*

Wisconsin.—The month was slightly warmer than usual and favorable

for the completion of fall work. Corn was secured early in the month in the southeastern counties and along the lake shore, where there was little damage from the early September frosts. Winter wheat and rye attained a good stand and is generally reported in excellent condition. Fall pasturage was very good throughout the month.—*W. M. Wilson.*

Wyoming.—The month was pleasant throughout the State, and favorable to the stock. No extremely cold weather or heavy snowfall was reported from any section of the State. In a few sections water for stock became scarce, owing to the absence of rain or snow; owing to lack of snow some stock could not be moved to the winter ranges.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

CLOUDBURSTS.

By A. D. ELMER, Voluntary Observer, Northfield, Mass.

I have seen the tracks of several so-called cloudbursts in New England and have also seen some of the storms themselves at a distance. Observers who happen to be in close proximity can determine whether these storms differ from thunderstorms except as to direction and velocity of motion. The cyclonic thunderstorm passes over the observer slantingly. If it moves broadside it passes over the observer quickly, with a tornado of wind; this is rare. Conversely, if it moves lengthwise, then it may last at one point until the whole length of the disturbance has passed over; in this case the observer experiences a calm with heavy rain. When the thundercloud moves transversely to the line of action it moves rapidly and, therefore, its short rainfall covers a wide area. In proportion as it moves more obliquely it is less squally, the area of precipitation is narrower, and the total amount heavier. If it moves along on the line of its greatest axis, the path of precipitation must be very narrow and the total amount very heavy; the most excessive amounts, of course, make the line of heaviest condensation. Therefore, such a local storm is capable of depositing as much water along a narrow track as a storm moving sidewise would do over a much wider area. The prevailing tendency of storms is to move in a median direction; those moving lengthwise are as rare as those moving broadside on. The latter, as described by Hinrichs, in Iowa, have a local name (*derecho*). The fact that they move along their short axis accounts for their covering a wide area, and for their being observed by many. The local storm that moves lengthwise being both infrequent and felt over a narrow area, is, of course, very rarely recorded. Its amount of precipitation may be still further increased at any given point by another characteristic. As above stated, the side-moving squall has the greatest velocity, the oblique-moving thunderstorm has less, and the disturbance which moves lengthwise sometimes seems to drag along. Let us consider the effect of this slow progress on an Indian file of pouring rain clouds when lifted in its march over a hill or mountain range. I have seen two such; one was climbing over the Northfield Mountains rising about 1,400 feet from the Connecticut River Valley; the other was passing up over the Hoosac Mountains, in Adams County, and rising about 2,500 feet from the valley of the Hoosac River. In such cases we have a continuous rain for hours along one line and which may amount to $\frac{1}{2}$ inch in five minutes, or 6 inches in one hour. If the storm line is 60 miles long and moves 20 miles per hour, 18 inches may fall in the three hours it occupies in marching over. Such being possible on the windward side of a mountain, at valley stations in New England thunderstorms, where the rate of fall occasionally equals 6 inches per hour, how long would it take a valley brook starting in the mountains to increase into a destructive body of water? It is probable that many of these storms are discontinuous, coming in series of showers. The one observed by me on the Northfield Mountains was at times so narrow that I could look under it and through the rain wall to distant Mount Toby; it lasted much of the afternoon and the brooks washed

out every culvert on the railroad for several miles. The storm in Adams County and that of June, 1902, at Middlesex, Vt., and northeast of that place were more destructive. Davis's Report on the New England Thunderstorms, 1885, furnishes good illustrations of storms which move broadside on (see July 21) and of the ordinary but severe thunderstorms (see July 9). I have not mentioned the occasional advance of an isolated thundershower, which being practically a point, has no breadth; but hope I have made it clear that the long thunderstorm cloud, advancing along its long axis may be directly responsible for all so-called cloudbursts.

DOES THE LIGHTNING EVER STRIKE THE OCEAN.

By Prof. JOHN TROWBRIDGE.

Prof. John Trowbridge, Cambridge, Mass., calls attention to the fact that—

Low lying clouds heavily charged may possibly sometimes discharge electrically to the surface of a large body of water like the sea; but he believes that his experiments show that at the average altitude of thunder clouds the tendency is to discharge from one region of cloud to another in preference to discharging to the sea. The testimony of persons who claim to have seen lightning strike the sea is not very reliable, since most persons are ignorant of the phenomena of irradiation, they are confused by the blinding flash and mistake reflection in the water for the flash itself.

He adds:

By means of a battery of 20,000 small cells a voltage of about 6,000,000 is obtained, which is at least comparable to that of lightning. With this large battery, I was able to obtain an electric spark about 7 feet long and found that instead of striking the water a spark of 6 or 7 feet in length invariably jumped to some adjacent object in preference to striking the liquid surface. A spark of only a few inches in length, however, will strike the water, but such a spark is not comparable to lightning.

Beyond a million volts the initial resistance of atmospheric air to electrical discharges becomes less, and the discharges, therefore, are shunted through the air instead of upon the water, and strike some object adjacent to the water.

THE CLIMATE OF BAGUIO, PHILIPPINE ISLANDS.

By FRANK O. STETSON, United States Weather Bureau.

Rev. Jose Algué, the Director of the Philippine Weather Bureau, has published an interesting study of the weather at Baguio, the first of a series of reports "On the climatological conditions of certain regions of the archipelago which might be advantageously chosen as health resorts." Baguio, on the island of Luzon, about 140 miles north of Manila and some 18 miles from the western coast, occupies a plateau 4,777 feet above sea level. The observations, which are taken ten times daily, are given in extenso for pressure, humidity, cloudiness, precipitation, fog, and wind direction. The record covers only a period of twelve months, but this will perhaps suffice for a general idea of the climate of a locality within 17° of the equator. The claims of Baguio as a health resort rest chiefly, if not entirely, upon its temperature. This, as the latitude and elevation would indicate, is delightfully mild and equable. During the period under examination it varied from a minimum of 47° in February, the coldest month of the year, to a maximum of 84° in April, which is the hottest month. The extremes at Key West, Fla., during the same period were 89° and 51°.

With the exception of a limited area on our Pacific coast, there is probably no section of the United States where yearly extremes would, as a rule, fall within the limits. A fairer idea of the variability of temperature is obtained from a comparison of records for corresponding hours. This shows a difference of 23° between the highest and the lowest temperatures recorded at noon and a variation of 16° in the 4 a. m. temperatures. The mean of the warmest month at Baguio is 6.5° lower than the mean of the coldest month at Manila.

The invalid would find the chief drawback to Baguio in the fog, cloud, and rain, which are excessive during the rainy season (May to December), and are of course accompanied by a high relative humidity. A record of 203 foggy days in the year is at first thought somewhat appalling, but is modified by the fact that the fog occurred, for the most part, during the night hours. The report does not explain just what constitutes a "fog," nor does it state whether all of the fogs recorded actually enveloped the observing station. The volume is commendable as to its tabular and graphical presentation and is a welcome addition to Philippine climatology.

SOME PECULIARITIES IN FROST FORMATION OVER THE COAST REGION OF SOUTH CAROLINA.

By L. N. JESUNOVSKY, Local Forecast Official, Charleston, S. C., dated Nov. 19, 1902.

Among the chief industries developed at Charleston, S. C., and on the sea islands contiguous thereto, in recent years, are the cultivation of asparagus, beans, cabbages, beets, onions, cucumbers, peas, potatoes, squashes, and other vegetables late in autumn, late in winter, and early in spring for shipment to market in the larger cities, where brisk demands are met by eager produce dealers and where the large yields of these products bring good prices. Truck farming has reached large proportions in this section; the acreage is now double the area of that cultivated but a few years ago. Large tracts of wooded lands are at present being cleared to meet the requirements of this widely expanding industry.

The writer has been intimately acquainted with the truck growing interests in and around Charleston during the past decade, since his connection with the Weather Bureau has brought him into close business relations with the farmers. In the discussions of crop growth and the effect of abnormal temperature and weather changes thereupon, reference has almost invariably been made to the peculiarities in frost formation upon the farms and truck gardens. One resident states that were it not for the fact that numerous patches of vegetables are unharmed while others are injured in the same field during the occurrence of frost, the matter would not receive the attention it deserves, since many suppose frost to form uniformly upon vegetation irrespective of physical conditions and surroundings. The main features of this somewhat complex phenomenon, as related by the said resident are: 1, frost spots, of both large and small dimensions; 2, alternate scorching of plants equally exposed, and, 3, the destruction of certain fields containing beans, peas, cabbages, etc., upon one plantation and the apparent safety of the same kind of plants in another portion or an adjoining plantation. The farms in the vicinity of Charleston are quite level; a few are slightly undulating but not to such a great extent as would by cold air drainage serve as a protection against frost on the more elevated portions thereof; consequently this slight unevenness of the land need not be taken into consideration in this discussion.

It is not my purpose in this paper to discourse upon frost warnings, the means and methods of protection against frost, nor the causes which tend to produce frost, but merely to state the peculiar effects of frost formation along the coastal region of South Carolina as I have found them.

The phenomena were first noted early in the fifties and have

engaged the earnest and thoughtful attention of many residents of this section ever since. Although discussed from various phases and standpoints, no one has up to the present offered any reasonable explanation of the cause of the three features above enumerated. Some of my colleagues, located at stations along the South Atlantic and Gulf coasts, may possibly have noted the same conditions or had their attention attracted thereto. It seems, however, that several gentlemen of marked scientific attainments, residing in the vicinity of Charleston, have pursued an unbroken series of investigations along this line for a number of years without having arrived at any satisfactory conclusions. Among the most distinguished of these was the late Rev. William Mueller, D. D., pastor of the St. Matthews Church, of Charleston, a botanist and biologist of considerable merit. From him it was learned that the staple crops of this section were subject to peculiar effects of frost formation. Cases were cited where during the occurrence of frost, both light and heavy in character, certain sections of the fields were burnt outright while in others vegetation was scarcely touched. Many cases were related where the frost appeared in circular patches, ranging in diameter from 3 to 10 feet or more. Somewhat more anomalous than the facts given above, may be noted the unaccountable occurrence of single and alternate plants, arranged in rows, being scorched by frost; yet, withal, those which intervened survived and showed but slight damage. It was also found that truck planted on the eastern side of groves of trees was less injured by frost than that grown on the western side of groves.

Having learned the views of Reverend Dr. Mueller and others, it was determined to pursue a series of investigations at length and to test more fully the accuracy of their observations. Upon the occurrence of frosts of different character within the past few years, the conditions under which they formed were carefully recorded; their effects upon young and tender vegetation were noted; those frosts were studied that were preceded by winds from each point of the compass, except the south point, a wind direction seldom preceding frosts in this locality. The conclusions were not so harmonious as at first hoped. Several of the cases were found to appear just as represented by the residents; others were not sufficiently defined to distinguish between abnormal frost formation and that which occurred ordinarily. With east winds the atmosphere was laden with decidedly more moisture consequently there could not have been such a copious formation of frost, while with westerly winds the atmosphere contained decidedly less moisture, requiring a lower depression of the dew-point for the precipitation of frost. This relation between light frosts attended by easterly winds and heavy frosts with westerly winds does not, in any manner whatsoever, offer any reasonable theory as to the causation of the peculiar formation of frost in question.

The spring of 1897 was remarkably free from frosts. The only frost formation recorded was on March 28. Mr. L. H. Sahlmann, on Charleston Neck, at Myers post office, had peas, cabbages, and beans growing upon his farm on that date. The place is well exposed and free from trees. The frost injured the plants slightly on the western edge of the farm but on the eastern side there was less damage. The injured plants survived but were much dwarfed; the yield was light. On the western side of the bean patch quite large areas showed drooping leaves of a deep green color; on the southeastern side of the same patch the color of the plants appeared of a much healthier hue. It may be observed here that the stems of the plants were not damaged at all and that the injury to each alternate plant as before mentioned was entirely lacking. No injury was done to the cabbages.

The accompanying tabulated statement of frosts is transcribed from the records of the United States Weather Bureau office, Charleston, S. C., and pertains to all frosts of each

autumn, winter, and spring for the period embracing the years 1897 to 1902. The effects of frost on such produce as was growing at the time are given in the subsequent text:

Frosts in the neighborhood of Charleston, S. C.

Spring frosts.				Autumn and winter frosts.			
Date.	Character.	Minimum temperature.	Wind direction.	Date.	Character.	Minimum temperature.	Wind direction.
1897.		°		1897.		°	
March 28.....	Light.....	41	n.	November 13.....	Light.....	48	ne.
1898.				November 18.....	Light.....	45	ne.
March 1.....	Heavy.....	39	n.	December 6.....	Heavy.....	40	n.
March 6.....	Light.....	44	ne.	December 7.....	Light.....	44	nw.
April 7.....	Light.....	43	n.	December 8.....	Light.....	45	w.
1899.				December 15.....	Heavy.....	42	w.
March 6.....	Light.....	42	nw.	December 16.....	Heavy.....	43	nw.
March 7.....	Killing.....	28	w.	December 17.....	Light.....	45	nw.
March 8.....	Killing.....	26	nw.	December 24.....	Heavy.....	45	n.
March 9.....	Light.....	43	sw.	December 25.....	Heavy.....	40	ne.
March 20.....	Light.....	42	w.	December 28.....	Light.....	40	n.
March 30.....	Light.....	47	n.	December 29.....	Light.....	40	ne.
April 2.....	Light.....	47	ne.	December 30.....	Heavy.....	47	sw.
April 5.....	Light.....	38	n.	1898.			
April 9.....	Light.....	44	nw.	October 27.....	Light.....	39	n.
April 10.....	Light.....	43	n.	November 1.....	Light.....	45	ne.
April 11.....	Light.....	45	nw.	November 12.....	Light.....	49	n.
1900.				November 20.....	Light.....	47	n.
March 2.....	Heavy.....	38	nw.	November 25.....	Heavy.....	37	n.
March 3.....	Light.....	44	n.	November 27.....	Killing.....	30	n.
March 4.....	Heavy.....	40	n.	1899.			
March 5.....	Light.....	47	e.	November 5.....	Light.....	48	nw.
March 17.....	Killing.....	35	nw.	November 6.....	Light.....	50	ne.
March 18.....	Light.....	42	ne.	December 5.....	Heavy.....	33	sw.
March 22.....	Light.....	45	e.	December 6.....	Killing.....	37	w.
April 1.....	Heavy.....	40	n.	1900.			
April 2.....	Light.....	46	sw.	November 9.....	Heavy.....	36	nw.
April 5.....	Light.....	39	n.	November 10.....	Heavy.....	40	ne.
April 6.....	Light.....	48	n.	November 11.....	Light.....	48	ne.
1901.				November 13.....	Light.....	39	w.
March 6.....	Killing.....	29	n.	November 14.....	Light.....	47	w.
March 8.....	Light.....	39	sw.	November 15.....	Light.....	50	nw.
March 15.....	Light.....	45	w.	November 27.....	Heavy.....	39	n.
March 16.....	Heavy.....	37	nw.	December 2.....	Heavy.....	40	n.
March 17.....	Heavy.....	35	nw.	December 5.....	Light.....	44	nw.
March 22.....	Light.....	43	nw.	December 6.....	Heavy.....	42	n.
April 4.....	Light.....	44	nw.	December 8.....	Light.....	44	nw.
1902.				December 9.....	Heavy.....	40	w.
March 3.....	Light.....	39	nw.	December 10.....	Heavy.....	43	n.
March 7.....	Light.....	40	ne.	December 11.....	Light.....	45	n.
March 19.....	Killing.....	30	n.	December 12.....	Heavy.....	39	ne.
April 1.....	Light.....	43	w.	December 13.....	Light.....	45	n.
April 2.....	Light.....	41	w.	December 16.....	Killing.....	33	n.
April 9.....	Light.....	38	w.	1901.			
				November 7.....	Light.....	43	n.
				November 9.....	Light.....	51	nw.
				November 15.....	Heavy.....	43	nw.
				November 16.....	Killing.....	34	n.

Frosts of a killing character were not noted during the autumn and winter of 1897, but they were frequent, light and heavy, after December 6. The first frost of the season formed on November 13, some days later than the average date, and was of an exceeding mild type. The spots so frequently spoken of were quite pronounced in this case. The farm of Mr. James Frampton, on James Island, opposite Charleston, was next visited on November 18, the same day upon which a light frost occurred. Mr. Frampton pointed out to the writer the areas most and least affected in his bean and potato fields. It was found that many portions of the bean patch, ranging in diameter from 5 to 50 feet, were scorched slightly, while in between these circular damaged areas there were many sections apparently untouched. In the potato field like conditions were observed. Both crops were harvested. The beans were mostly all killed outright by a heavy frost on December 6. Those that remained uninjured had been planted near a small grove of oaks and yielded well until December 25, when another heavy frost completed the damage. The potato vines which had but a short time previous appeared in the last stages of blossoming, were injured to such an extent that the young tubers were gathered, shipped, and sold as early Bermudas.

The spring of 1898 was somewhat mild; only three frosts were recorded; that of April 7, the last of the season, was more destructive than those of March 1 and 6. Considerable loss was sustained upon the farm of Mr. E. H. Gadsden, in old

St. Andrew's parish. The frost formed early in the morning; it was seen at daybreak, but not after sunrise, although its effects were plainly visible, as was evidenced by the well known sickly look of the plants. This truck farm contains about 500 acres, being surrounded on three sides by forests of prodigious growth, a condition for so large an area, not likely to prevent frost formation. One of the most tender plants is the cucumber, which readily succumbs to the least burning influences of frost. That an idea may be obtained of the expression burnt black, as used by the truck growers of this locality, it may be stated that the "cukes" upon Mr. Gadsden's place really turned very dark in color and appeared much shriveled after the freezing process took place. Fully one-eighth of the crop was uninjured—that is that portion of the cucumber field bordering on the State road, where a double row of large pine and gum trees stand. The cucumber field was replowed on the same day; replanting began the next day; germination took place on the fifth day following. The beans, peas, potatoes, and melons were not damaged very much, except that their growth was greatly retarded. The peculiar effects heretofore mentioned were an accompaniment of the frost of April 7, 1898. Mr. Gadsden remarked that when he arrived on the fields that morning he was of "firmer opinion, than formerly, that some other agencies or forces other than those of frost were at work in assisting nature in its own self destruction." The potato plants showed good stands at the time of the frost. On the northwest side of the field the usual effects were felt again in circular areas. It was noticeable that in some areas the stems of the potato vines that had been touched did not recover so rapidly as in others. To what agency this was attributable can only be conjectured. The peas and beans located far over toward the southeastern edge of the plantation were the least damaged.

Nothing appears so desolate and dreary as a field of agricultural products laid waste by frost in a single night, representing, as it does, an equivalent loss in time, labor, wear and tear of implements, machinery and stock, and the cost of seeds or plants. Such a sight met the gaze of the writer during a trip to the plantation of Mr. John Brannen, in old St. Andrew's parish, across Ashley River, in the suburbs of Charleston, on November 28, 1898. The autumn season of 1898 had been a prosperous one. Four frosts intervened between the date of the first light frost on October 27 and the date of the first killing frost on November 27. The first light frost of October 27 proved somewhat detrimental to the trucking interests, owing to the low minimum temperature attendant thereon. As a whole, the crops of beans, peas, potatoes, and cabbages withstood the damaging effects of these frosts quite well up to the time of the first killing frost as before mentioned. Mr. Brannen had planted a crop of beans comprising upward of some 100 square acres, unusually late. The preceding crop yielded well, was fully harvested, and brought good prices. The last crop had already bloomed and was beginning to bear when a killing frost on November 27, with a minimum temperature of 30°, destroyed the entire acreage outright. At the same time Mr. Brannen had 150 acres of winter cabbages, in the heading stage, which were scorched or injured to such an extent that nearly two months elapsed before they regained their former vitality. He immediately reset the same acreage in young cabbages, which matured in a little less than three weeks after the first or scorched cabbages had fully matured. Somewhat yet more remarkable than this may be mentioned: At the time of the injury to Mr. Brannen's first crop of autumn cabbages, on November 27, a neighbor in an adjoining field on the opposite side of the State road, about 300 feet distant, had set out about 50 acres in young cabbages just two weeks to a day before the first killing frost of the season occurred on November 27. This field of young cabbages was unhurt. Here were much younger plants that did not succumb to the frost

and freezing temperatures, while the older and more matured plants were badly injured, irrespective of the surroundings. Mr. E. Ravel, who is probably one of the oldest planters in old St. Andrew's parish, has given much attention to the effects of frost upon young and tender vegetables. This gentleman's experience dates from the days of old-style farming, when fertilizers were not in such frequent use. The gentleman stated that he has known whole rows of vegetables to be burnt badly when other rows of the same kind were unscathed and recalled many such cases.

The spring of 1899, while not particularly devoid of low frost temperatures, remained mild up to and including April 20. On April 5, 1899, a heavy frost formed which almost created a financial panic among the farming community. Although advised of the approach of frosts, yet the means and methods of protection against frost have been so expensive to the farmer in late years as to preclude the idea of any further investments for this purpose, consequently the destruction of the crops was widespread. Entire fields were completely annihilated. Replanting was resorted to and begun immediately, creating such a demand for labor as was scarcely ever equaled before in this section. The crops of the second planting were marketed somewhat earlier than those of the North Carolina and Virginia raisings, and in consequence there was a greater demand, and correspondingly advanced prices prevailed. The frosts subsequent to April 5 were pronounced mild types, and did not materially lessen the yield. In connection with the frequent occurrence of frosts during the spring of 1899 it may be remarked that as the subject was more generally discussed among the planters of St. Andrew's and Christ Church parishes, on Charleston Neck, James Island, Wadmalaw Island, Youngs Island, and Edisto Island, S. C., it followed that cases in which frost spots formed and alternate plants burnt were more numerous observed. On March 30 and April 10 and 11 there were especial marked characteristics. The writer observed the following somewhat curious phenomenon. It may at first be necessary to describe the conditions under which these frosts formed in order to more fully understand the matter. The light frost of March 30, 1899, was attended by a minimum temperature of 47° , the wind was from the north, and the velocity 5 miles per hour; April 10, 43° north, 14; April 11, 45° northwest, 5.

On March 30 the garden truck belonging to Mr. E. Ravel, such as peas, potatoes, asparagus, and beans was well out of ground. This farm lies almost level; it is almost entirely surrounded by large forests of native pine, on the western, northern, and eastern sides, with a clean sweep of open country to the southward for one and a half miles. During the frost of March 30, 1899, and in the fields of peas, could be seen in all directions that well known droop among single plants, indicative of frost formation, while, in the same directions, could be seen healthy plants without blemishes of any kind in large numbers. The frost seemingly had formed in circular spots over this as well as over the fields of asparagus, potatoes, and beans. There is another peculiarity in frost formation not previously described, and that is its damaging effect on the asparagus plant. When nipped by frost this plant does in reality turn very black. In cutting open one of these succulent vegetables it was found that the outer shell or skin had undergone some chemical change unknown to the writer. The inner portion, or meat of the plant, was decidedly soft and stringy and the liquid could be squeezed therefrom as if out of a sponge. The general characteristics of the frosts of April 10 and 11 were much the same as those of the frost of March 30.

The spring and autumn of 1900 were fraught with many disasters among the truck farms of this locality; frosts were more frequent than for many years previous thereto and the phenomena noted in this article were frequently seen. The

frosts of April 5 and November 9, 1900, were quite destructive in their effects. The writer visited the plantations of Mr. W. F. Kracke and Mr. James D. Croghan, in old St. Andrew's parish, and those of Mr. Robert Nix, Henry D. Williams, and J. S. Horlbeck, in Christ Church parish, at Mount Pleasant, S. C., a suburb of Charleston, and verified the same effects of frost during the spring and autumn of 1901 and the spring of 1902. The truck growers of this locality have become somewhat ingenious. They plant peas and cantaloupes side by side in alternate rows and three feet apart within the same field. In the event of either of the plants becoming badly injured that particular row is turned over by the plow and planting is begun over again within a few inches to the right or left of the rows that were destroyed or injured.

In seeking the cause of the irregular effects of frost formation, some attribute these injuries to the excessive use of fertilizers, and others to the ground water that elevates the temperature of the surface and prevents rapid radiation from the vegetation. The former view is untenable since all lands are covered with fertilizers evenly and alike according to the desired strength required, and it would be an almost physical impossibility to distribute the fertilizers otherwise. With respect to the ground-water theory there can be but one answer. It is known that plants near large bodies of water suffer from frost less than those located over level and dry land. Assuming then that moist air or soil is a better preventative against frost than drier air or soil, something can be said in favor of the ground-water theory. But upon further examination it is found that the lands upon which this peculiar local frost formation took place appeared equally dry or moist for a few feet below, agreeing precisely with climatic conditions. Again, local currents of air, somewhat warmer and more moist than the surrounding bodies of air, may have served to check frost formation to a limited extent and thus caused less damage than at points where the colder air settled. There is a bare possibility that the salt in the air of this section may have had some influence upon the vegetation, thus preventing a deposit of frost upon it. It is known that objects coated with salt require lower temperatures for congelation than those not so coated.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

GENERAL SUMMARY FOR OCTOBER, 1902.

Honolulu.—Temperature mean for the month, 75.8° ; normal, 76.4° ; average daily maximum, 81.8° ; average daily minimum, 70.3° ; mean daily range, 11.5° ; greatest daily range, 17° ; least daily range, 6° ; highest temperature, 84° ; lowest, 67° .

Barometer average, 29.969; normal, 29.967; highest, 30.10, 15th; lowest, 29.84, 6th; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, .07; lows passed this point on the 6th and 25th; highs on the 10th and 15th. The pressure has been even through the month.

Relative humidity average, 74.5 per cent; normal, 71 per cent; mean dew-point, 66.6° ; normal, 66.2° ; mean absolute moisture, 7.17 grains per cubic foot; normal, 7.05 grains; dew, 11 morning.

Rainfall, 2.59 inches; normal, 2.76 inches; rain record days, 20; normal, 19; greatest rainfall in one day, 1.05, on the 15th; total at Luakaha, 13.12 inches; normal, 11.69 inches; total at Kapiolani Park, 0.73 inch; normal, 1.12 inch.

The artesian well level stood for the month without falling, 32.95 feet above mean sea level. October 31, 1901, it stood at 33.12. The average daily mean sea level for the month was 10.05 feet, the assumed annual mean being 10.00 feet above datum. For October, 1901, it was 10.37. Trade wind days, 21 (7 of north-northeast); normal 22. Average force of wind during daylight, Beaufort scale, 2.1. Average cloudiness, tenths of sky, 3.3; normal, 4.3.

Approximate percentages of district rainfall as compared

with normal: Hilo, 100 per cent; Hamakua, 115 per cent; Kohala, 155 per cent; Waimea (Hawaii), 75 per cent; Kona, 170 per cent; Kau, 70 per cent; Puna, 100 per cent; Maui, 150 per cent; Oahu, 95 per cent; Kauai, 135 per cent.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 80.4°; mean minimum, 69.5°; Waimea, Hawaii, 2,730 elevation, 82.3° and 65.7°; Kohala, 521 elevation, 79.3° and 67.5°; Waiakoa, Kula, Maui, 2,700 elevation, 78.5° and 60.0°; Ewa Mill, 50 elevation, 84.8° and 67.5°; United States Experiment Station, Jared W. Smith, 350 elevation, 83.4° and 70.2°; W. R. Castle, 60 elevation, highest, 84°; lowest, 66°; mean, 75.2°.

Ewa Mill mean dew-point, 64.6°; mean relative humidity, 68.7 per cent; Kohala, Dr. B. D. Bond, 66° and 78 per cent.

Slight but decided earthquake felt at Honolulu, 4:31 a. m., 16th, day of lunar eclipse; same reported from Kohala, Waimea, 2 shocks, and Hilo, Pepeekeo. On the 20th, Kohala, 5:30 a. m., 26th, Waimea, 3:05 and 11:05 p. m. Heavy swell and surf 15th, 17th, 27th, and 28th. Heavy rains, 3d, 15th, and 27th.

Heaviest 24-hour rains reported: Rhodes Gardens, 4.23 inches; Waiakoa, Hilo, 3.31 inches; Luakaha, 4.00 inches, 27th; Puuhua, Hilo, 3.43 inches, 14th.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18' N., 157° 50' W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.) Hawaiian standard time is 10° 30' slow of Greenwich time. Honolulu local mean time is 10° 31' slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other. The rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, October, 1902.

Date.	Pressure at sea level.		Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.							Total rainfall at 9 a. m., local time.	
	Dry bulb.	Wet bulb.	Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.			
			Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.		
1	29.89	72	68.5	84	70	67.0	72.7	ne.-n.	2-1	7-1	29.95	29.86	0.00
2	29.95	68	67.3	84	72	66.3	72.2	n.	1	4-2	29.98	29.87	0.00
3	29.98	75	69	84	68	68.0	70.9	nne.	1	3	30.02	29.93	0.13
4	29.97	73	69	83	72	66.0	67.0	ne.	3	3	30.03	29.94	0.02
5	29.95	69	67.7	80	73	66.0	71.1	ne.	3-1	7	30.04	29.95	0.11
6	29.92	68	67	83	68	68.5	82.2	nne.	2	3-9	30.00	29.91	0.01
7	29.89	70	68	82	67	68.3	87.8	ne.-sw.	1-0	8	29.94	29.84	0.03
8	29.91	72	71.5	82	67	69.0	82.2	s.-sw.	1-0	3	29.94	29.86	0.08
9	29.94	70	69	82	71	71.0	85.5	sw.	1-0	5	29.97	29.88	0.03
10	29.92	70	68.7	82	70	70.0	85.5	sw.	1-0	3	30.03	29.93	0.02
11	29.98	75	70	83	69	69.0	83.3	n.-ne.	1	6-0	30.07	29.97	0.00
12	29.94	75	70.5	84	68	67.7	73.3	nne.	2	1	30.04	29.94	0.21
13	29.94	76	69.5	83	71	67.0	70.0	ne.	3-5	2-7	29.99	29.90	0.04
14	29.95	75	69	81	72	66.7	70.0	nne.	5-2	7-2	29.99	29.89	0.15
15	30.05	74	67	80	72	67.3	74.7	ne.	3-4	7	30.06	29.96	1.05
16	30.05	74	66	79	70	62.7	67.7	nne.	5-0	2	30.10	30.03	0.00
17	30.02	69	64	80	73	62.0	63.3	ne.	3	7-2	30.09	29.99	0.01
18	29.98	73	66.5	81	68	62.3	66.6	nne.	3	3	30.04	29.94	0.00
19	29.99	75	67	81	73	62.0	64.4	ne.	3	2	30.04	29.94	0.00
20	30.03	74	68	81	74	63.3	64.4	ne.	3	3	30.06	29.96	0.01
21	29.97	73	67.5	80	72	64.0	66.6	ne.	3	4	30.06	29.97	0.00
22	29.96	71	68.5	82	72	65.5	72.2	ne.	3-1	3	30.02	29.91	0.00
23	29.96	68	67	83	68	67.7	78.2	se.-ne.	1-0	6-3	30.00	29.91	0.01
24	29.96	67	66	82	68	67.7	82.2	sw.-n.	1-0	7-1	30.00	29.91	0.01
25	29.94	60	68.5	83	67	66.3	76.8	s.-ne.	0-2	2	30.00	29.88	0.02
26	29.93	74	69	84	67	68.0	78.2	se.-ne.	1-2	2	29.98	29.91	0.00
27	29.99	75	71	82	72	66.5	74.7	ne.	3	1	30.02	29.92	0.15
28	29.97	74	70	78	72	68.7	84.4	nne.	4	5	30.08	29.98	0.45
29	29.94	76	71	81	72	67.7	77.7	ne.	4	4	30.01	29.91	0.03
30	29.94	73	68.5	81	73	67.7	74.7	ne.	3-4	5	29.97	29.87	0.00
31	29.95	66	65	82	73	64.5	66.6	nne.	3	1	30.00	29.92	0.00
Sums													2.59
Means	29.963	72.5	68.2	81.8	70.3	66.6	74.5		2-1	3.3	30.017	29.922	
Departure	+ .002					+0.4	+3.5			-1.0			-0.17

Mean temperature for October, 1902, (6+2+9)+3=75.8; normal is 76.4. Mean pressure for October, 1902, (9+3)+2=29.969; normal is 29.967.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of (6+9+2+9)+4. § Beaufort scale.

Rainfall data for October, 1902.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.			MAUI.—Continued.		
HILO, e. and ne.			Feet. Inches.		
Waiakoa	50	12.37	Paia	180	2.15
Hilo (town)	100	12.12	Haleakala Ranch	2,000	4.00
Kaunana	1,250		Wailuku, ne.	200	0.94
Pepeekeo	100	11.52	OAHU.		
Hakalau	200	12.13	Punahou (W. R.), sw.	47	2.50
Honohina	300	12.94	Kulaokahua (Castle), sw.	50	2.16
Punohua	1,050	18.98	Makiki Reservoir	120	2.96
Laupahoehoe	500	11.78	U. S. Naval Station, sw.	6	1.56
Ookala	400	10.14	Kapiolani Park, sw.	10	0.73
HAMAKUA, ne.			Manoa (Woodlawn Dairy), e.	285	11.75
Kukui	250	6.95	Manoa (Rhodes Gardens), e.	300	15.46
Paauilo	750	6.26	School street (Bishop), sw.	50	2.95
Paauhau (Mill)	300	4.62	Insane Asylum, sw.	30	2.15
Honokaa (Muir)	425	4.75	Kalihi-Uka, sw.	450	9.13
Honokaa (Meinicke)	1,100	5.93	Nuuanu (W. W. Hall), sw.	50	3.04
Kukuihaele	700	5.49	Nuuanu (Wyllie street)	250	5.12
KOHALA, R.			Nuuanu (Elec. Station), sw.	405	5.85
Niuli	200	5.83	Nuuanu (Luakaha), e.	850	13.12
Kohala (Mission)	521	5.93	Waimanalo, ne.	25	2.69
Kohala (Sugar Co.)	235	5.98	Maunawili, ne.	300	5.42
Puakea Ranch		3.29	Kaneohe	100	4.31
Hawi	600	1.54	Ahuimanu, ne.	350	5.75
Puuhue Ranch		2.37	Kahuku, n.	25	3.22
Waimea	2,720		Wahiawa	900	0.79
KONA, W.			Ewa Plantation, s.	60	1.64
Kailua	950		Waipahu	200	0.65
Holualoa	1,350	9.03	Moanalua	15	1.83
Kealahou	1,580	11.20	U. S. Magnetic Station	50	1.35
Napoopoo	25	5.90	Tantalus Heights	1,300	11.99
KAU, SE.			U. S. Experiment Station	350	3.81
Kahuku Ranch	1,680	2.87	Upper U. S. Exp. Sta. (Castle)	1,150	10.56
Honapo	15	1.38	KAUAI.		
Naalehu	650	2.17	Lihue (Grove Farm), e.	200	5.06
Hilea	310	0.60	Lihue (Molokaa), e.	300	4.92
Pahala	850	1.72	Lihue (Kukaua), e.	1,000	12.53
Moaula	1,700		Kealia, e.	15	3.96
PUNA, E.			Kilauea, ne.	325	7.19
Volcano House	4,000	3.18	Hanalei, n.	10	9.32
Olaa, Mountain View (Russel)	1,690	11.36	Waioli	10	7.40
Kapoho	110	8.63	Waiawa	32	
MAUI.			Elele	200	
Lahaina			Wahiawa	2,100	
Waipae Ranch	700	0.62	Lawai	200	5.37
Kaupo (Mokulau), s.	285		Delayed September reports.		
Kipahulu, s.	300		Kaunama		
Nahiku, ne.	60		Waipae Ranch (Maui)		1.98
Nahiku	800		Haleakala Ranch (Maui)		3.08
Haiku, n.	700	6.32	Wahiawa (Oahu)		2.63
Kula (Waiakoa), n.	2,700	1.68	Waiawa (Kauai)		0.00
Kula (Erehwon), n.	4,500	2.81	Wahiawa Mt., s (Kauai)		10.20
Puomalei, n.	1,400	6.16			

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on earthquakes.—October 9, slight shock at 4^h 6^m p. m., duration 2 seconds. October 13, medium shock at 4^h 29^m a. m., duration 9 seconds. October 14, slight shock at 5^h 49^m a. m., duration 7 seconds. October 15, slight shock at 2^h 10^m a. m., duration 5 seconds.

CYCLES OF PRECIPITATION.

By L. H. MURDOCH, Section Director, Salt Lake City, Utah, dated October 20, 1902.

In Utah a cycle of unusually heavy precipitation began in 1866 and continued until 1886. During that period the old settlers confidently asserted that the climate had changed to wetter and even men of scientific training tried to explain the increased precipitation as due to human agencies. It was stated that the humidity had been greatly increased by breaking up the land, irrigation, increased vegetation, etc. Since 1887 the precipitation has been deficient and nothing is now heard on the subject of human agencies increasing the humidity. Most men who spent their youth here between 1866 and 1886 will now tell you that the climate has changed to drier.

It is, therefore, evident that the person who forms the opinion that climate is changing, based upon his own personal experience, is very likely to be mistaken. And yet no one who has stood near Salt Lake City and observed on the mountain sides the shore lines of the ancient Lake Bonneville can doubt for a

moment that the climate of the Great Basin has undergone a very decided change. The maximum height of the old fresh water lake was about 1,000 feet above its remnant, Great Salt Lake, and its depth at the point where Salt Lake City now stands was something like 900 feet. Lake Bonneville covered the western half of Utah and small portions of eastern Nevada and southern Idaho. Its waters were discharged through Red Rock Pass, in southern Idaho, and finally reached the Pacific Ocean through the Columbia River. During the existence of the lake its outlet was lowered 375 feet by erosion, producing a corresponding fall in the lake itself.¹

The lake existed as long as precipitation was in excess of the evaporation and this was for thousands of years. The mere fact that a lake has disappeared does not necessarily demonstrate that this change is due to increased evaporation or diminished rainfall, but, after a careful investigation of the subject, Gilbert concludes that the disappearance of Lake Bonneville can be accounted for only by a change in climate. (See *Lake Bonneville*, pages 262 to 265.)

Gilbert's studies of this region show that preceding the epoch of high water was a period during which the basin was nearly or quite dry. This period exceeds in length the time that has elapsed since the Lake Bonneville epoch. And still preceding that period of drought was another humid epoch during which the water rose to within 90 feet of the Lake Bonneville stage and continued five times as long.

Geologists generally agree that there were two periods of glaciation on the Northern Hemisphere. An epoch of much warmer weather separates the two, during which most of the ice disappeared. It seems probable that the two great lakes which have covered this basin were produced by the same conditions, which caused the two periods of glaciation, and were therefore coexistent with them.

Many theories have been advanced to explain these great vicissitudes of climate, but the question is far from settled.

The changes in climate which geology seems to require were so slow that they probably would not be appreciable in the most carefully kept record in a thousand years, but a study of the precipitation record of any locality will show that there are extended periods of comparatively dry weather followed by a number of years with excessive precipitation, and these in turn by a cycle of dry years. During the twenty-one years, from 1866 to 1886, the average annual precipitation at Salt

Lake City was 18.49 inches, or 1.84 inches more than the average for the entire record, and during the first thirteen years of this wet cycle the average precipitation was 20.08 inches, or 3.43 inches greater than the average for all years. The average precipitation for the fifteen years, from 1887 to 1901, was only 15 inches, which is 1.65 inches below the average for all years.

While no authentic rain gage records were kept in this vicinity prior to 1863, a very good record of the precipitation was kept by the water level of Great Salt Lake.

Fig. 1 shows how nicely the water level has responded to the precipitation to within the last few years. As a result of the excessive precipitation, the lake reached a maximum level of about 13 feet in 1868 and again in 1876. The maximum level for 1886 was a little over 9 feet; responding to the dry cycle which began the following year, a fall began and continues at the present time. The level on October 1, 1902, was 2 feet 8 inches below the zero of the gage, showing a decline of nearly 12 feet since 1886, and an extreme range of about 16 feet.

Irrigation has undoubtedly been a factor in bringing about the present low level, but it is equally certain that the main factor has been the deficiency in precipitation. The divergence between the precipitation and the lake lines for the last few years is evidently due, in part at least, to the accumulated effects of the drought.

When the Mormon settlers entered the valley in 1847 the lake level was nearly as low as at present. The position of the storm line and the growth of sage and other brush down to this line led Gilbert to conclude that it had been many years and perhaps even centuries since the lake had been above the storm line of 1847. In order to throw further light upon the subject, the writer recently made an examination of the lake shore to determine how far down the brush is now growing. A fairly good growth of sage brush and grease wood was found between the 1876 and the 1886 lines, grease wood predominating. The growth of brush on the shore in 1847, therefore, can not be used to prove that the low water of that period had existed for a greater time than from sixteen to twenty-six years, but from all the data available it seems more than probable that it had existed for at least twenty years. This being the case, it can be assumed that a dry cycle began as early as 1827; this cycle continued until 1864, or about thirty-seven years. Judging from the lake level, it is safe to estimate that the average annual precipitation during these years was not over 15 inches.

For Salt Lake City, then, we have a dry cycle extending from 1827 to 1864, during which the average annual precipitation was about 15 inches; from 1865 to 1886, a wet cycle, with an average annual precipitation of 18.42 inches; and from 1887 to the present time a dry cycle, the average annual precipitation from 1887 to 1901 being 15 inches.

Having outlined the wet and dry cycles for Salt Lake City, it will now be found instructive to examine the records of other localities for the same purpose. The stations selected are in about the same latitude as Salt Lake City and include San Francisco, Sacramento, Denver, Omaha, St. Louis, Cincinnati, and Baltimore. According to records extending back to 1850 the wettest twenty consecutive years at both San Francisco and Sacramento were from 1866 to 1885; at Denver, the seventeen years from the beginning of the record, in 1870, to 1886 were the wettest; the record was begun at Omaha in 1871 and shows the first sixteen years to be the wettest; at St. Louis and Cincinnati, from records extending back to 1839 and 1838, respectively, the wettest twenty consecutive years were from 1840 to 1859; at Baltimore the record is broken prior to 1871 and the wettest twenty consecutive years there were found to be from 1873 to 1892.

From the foregoing it appears that the country west of the

¹The position of the surface of the lake represents the varying balance between rainfall and inflow, on the one hand, evaporation and outflow, on the other. A variation in any one of these four items will cause a variation of the level of the lake. The direct rainfall is measured with comparative ease, and our records go back with considerable accuracy for about forty years; but we know almost nothing of the variations in evaporation and in the outflow and inflow. Of course, the variations in the area of the watershed that feeds the Great Salt Lake appear to have been almost inappreciable in recent years, but this was not so in the older geological eras, when Lake Bonneville was full. Similarly, at the present time we think of the Great Salt Lake as having no outflow, but in former ages Lake Bonneville had an outlet, and its outflow varied from age to age with the wearing away of gorges and waterfalls. Even at the present time the inflow to the lake must vary with changes in the soil and vegetation and the depth of the streams and the quantity of water consumed in irrigation, or, in other words, lost by evaporation from the watershed before it can reach the lake. A slight change in the general inclination of the basin immediately adjoining the lake, by which the present dry lowlands become covered with water, would immediately increase the evaporation to a very large extent. Such tilting of the land seems to have been already demonstrated by the observations of G. K. Gilbert in the region of our Great Lakes. (See the 18th Annual Report of the United States Geological Survey or The National Geographic Magazine, September, 1897.) Similar changes undoubtedly took place in Lake Bonneville, and may even have an appreciable effect over an area as small as Great Salt Lake. It is, therefore, evident that the geological and meteorological conditions that conspire to change or preserve the level of any lake surface constitute such a complex combination that we can not rationally argue from the changes in water level back to changes in rainfall or evaporation. There are five or six elements in the problem, and our or five of these must be given before we can conclude anything with certainty with regard to the remaining one.—Ed.

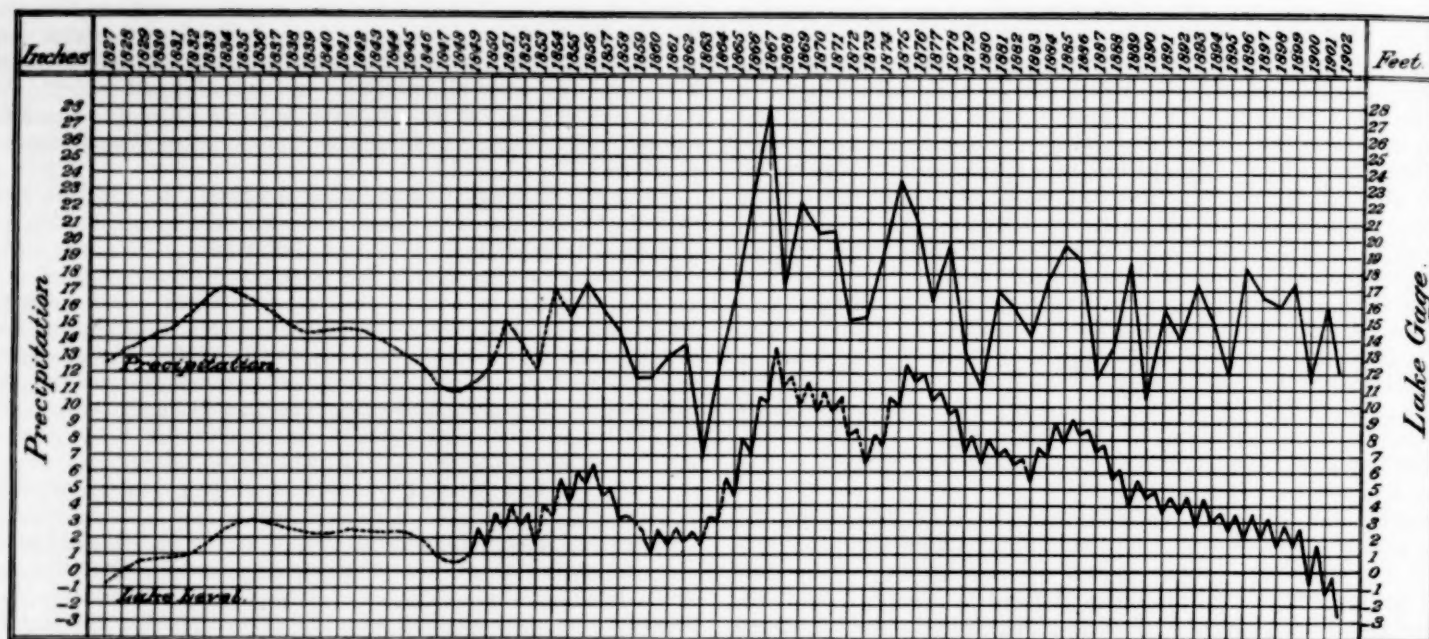


FIG. 1.—Annual precipitation at Salt Lake City and water level of Great Salt Lake.

EXPLANATORY NOTES.

The upper line indicates the precipitation and the lower one the lake level. Dotted lines indicate periods of no authentic observations, or that the data have been approximated; the position of the storm line in 1847 and the growth of sage brush down thereto are the only data upon which both the lake and precipitation lines prior to 1847 are based, except an observation by Fremont in 1845.

Rocky Mountains had its wettest cycle from 1866 to 1887, while the middle Mississippi and Ohio valleys received their heaviest precipitation from 1840 to 1859. It will be observed that while the central portion of the country was receiving an abundance of moisture, the country west of the Rocky Mountains was passing through the longest dry cycle of which we have any record.

The dry cycle that prevails at present is general from San Francisco to Baltimore. The past fifteen years have been the driest fifteen consecutive years on record for all the stations named, except Sacramento, and the drought is equally well marked there, but the fifteen years from 1851 to 1865 were a trifle drier.

How long will the present dry cycle continue? A correct answer to this question would be worth millions of dollars to the people of the United States and be especially valuable to those living in the arid regions.

During the first few years after Utah was settled irrigation was necessary and no "dry" farming was attempted; but during the latter part of the sixties, after an apparent change in climate, it was found that handsome crops of grain could be raised without irrigation, and up to the end of this wet cycle more and more land was broken up for this "dry" farming.² During the past fifteen years "dry" farming has generally been a failure and is now being largely abandoned; in fact in several settlements, mostly in the west-central portion of the State, irrigation water has itself become so scarce that very small crops have been raised for several years, and if a continuance of the present dry cycle could be forecast, there would be a general exodus from those parts. The Southern Pacific Company is now extending its road across the north end of Great Salt Lake. Judging from past levels, the track should be placed from 16 to 20 feet above the present level to provide for high water. If it could be forecast that the present dry cycle would continue twenty years longer it would probably

The precipitation record at Salt Lake City for 1901 does not fairly represent conditions for the entire drainage basin; from April 2 to 4 4.08 inches of rain fell at Salt Lake City, but this excessive precipitation covered only Salt Lake and Davis counties, and small portions of adjoining counties, about one-twentieth of the basin, while the rainfall was comparatively light over other portions.

mean a saving of at least a million dollars to this company alone. Still another case in point is that of the Great Lakes, which have become so low in recent years as to interfere with navigation. The Government has made financial provision for investigating this difficulty and for the formation of a practical plan for raising the water level. The level will probably be raised by the construction of a dam costing millions of dollars. If it were known that the next twenty years would be unusually wet this expense would be unnecessary for the present.

Many students of the subject have studied the fluctuations in weather conditions as dependent upon sun-spot cycles. The investigations of Wolf and Wolfer, of Switzerland, show that the short sun-spot cycles vary in length from 9 to 13.6 years and that there are grand cycles of increase and decrease, both seeming to cover a period of about fifty-five years.

In comparing precipitation records with sun spots some investigators have found that a maximum of sun spots is accompanied by a deficiency of precipitation and a minimum by an excess, while others equally reliable, but using the precipitation records of different localities, have found the opposite conditions to exist.

The writer has compared the Salt Lake City precipitation record with Wolfer's Sun-spot Tables, published in the MONTHLY WEATHER REVIEW for April, 1902, but has been unable to discover any relation whatever between them. Years of minimum sun spots are sometimes excessively wet and sometimes excessively dry, and the same may be said of years of maximum sun spots. It seems pretty well settled that no well-defined connection exists between the short sun-spot cycles and the precipitation. This may also be said of the 55-year period, but the precipitation records are too short to permit a full investigation of the subject. But there are sufficient data to show that if a relationship does exist it is rather complex. For example, the sun-spot curve for the period from 1840 to 1859 does not appear to differ materially from that from 1887 to 1901. During the first period the central portion of the United States was in a wet cycle, while the country west of

² Dry farming is done on land which can not be irrigated.—L. H. M.

the Rocky Mountains was a in very dry one. During the latter period a dry cycle prevailed from San Francisco to Baltimore.

We shall, therefore, have to conclude that there is no known natural law by which we can predict the length of the present dry cycle. The data shows that weather equally as dry prevailed west of the Rocky Mountains for a period of at least thirty-seven years. If it were known that these recurring periods were of equal length no change for the better could be expected in the intermountain country until about 1924, but it is probable that these periods vary in length and, if this be true, they can not be used as an index to the future until much more data and knowledge are accumulated.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a —.

- Quarterly Journal of the Royal Meteorological Society. London. Vol. 28.*
Dines, W. H. and Wilson-Barker, D. Report on the Wind Force Experiments on H. M. S. *Worcester* and at Stoneness Light-house. Pp. 217-228.
Mill, Hugh Robert. The Cornish Dust-fall of January, 1902. Pp. 229-252.
 — Distribution of Fog in Switzerland. [Note on article by Gottfried Streun.] Pp. 252.
Bayard, Francis C. [ampbell]. English Climatology, 1891-1900. Pp. 253-281.
Dallas, W. L. Earth Temperature Observations recorded in Upper India. Pp. 283-299.
 — Pressure and Temperature Results for the great Plateau of South Africa. [Review of article by J. R. Sutton.] Pp. 302-304.
Geographical Journal. London. Vol. 20.
Markham, Clements R. Arctic Problems. Pp. 481-485.
Skottsberg, C. Geographical Distribution of Vegetation in South Georgia. Pp. 498-502.
Nature. London. Vol. 66.
S[cott], R. H. The International Meteorological Committee. P. 608.
Schuster, Arthur. The British Association at Belfast. Section A. Subsection of astronomy and cosmical physics. Opening Address. Pp. 614-618.
Shaw, William N. [apier]. The Treatment of Smoke: a Sanitary Parallel. Pp. 667-670.
Symons's Meteorological Magazine. London. Vol. 37.
Shaw, W. N.; Archibald, D.; Boys, C. V.; Buchan, A.; Dines, W. H.; Mill, H. R. Investigations of the Upper Atmosphere by Means of Kites. Pp. 134-138.
Mill, Hugh Robert. The Rainfall of Ireland. Pp. 138-140.
Ellis, William. The Moon and Rainfall. Pp. 142-143.
Hopkinson, John. The Meteor of July 13. P. 143.
 — The Climate of Pemba in 1901. P. 144.
Scientific American. New York. Vol. 87.
 — The Commercial Utilization of Atmospheric Elements. Pp. 254-255.
Grimsaw, Robert. Barometer Readings. P. 305.
Weir, James. The Physiology of Certain Colors. Pp. 339.
 — Popp-Branly Aerial Telegraphy Systems. Pp. 341-342.
Scientific American Supplement. New York. Vol. 54.
 — The New Weather Vane of the Eiffel Tower. Pp. 22489.
Astrophysical Journal. Chicago. Vol. 16.
Barnard, E. E. Observations of the Aurora made at the Yerkes Observatory, 1897-1902. Pp. 135-145.
Burns, Gavin J. The Total Light of all the Stars. Pp. 166-169.
Proceedings of the Royal Society. London. Vol. 71.
Lyons, H. G. Magnetic Observations in Egypt, 1893-1901. Pp. 1-25.
Bulletin of the American Geographical Society. New York. Vol. 34.
Ward, Robert DeC. Notes on Climatology. Pp. 333-337.
London, Edinburgh, and Dublin Philosophical Magazine. London. Vol. 4.
Bottomley, J. T. On Radiation of Heat and Light from Heated Solid Bodies. Pp. 560-569.

- Journal of Geography. Lancaster. Vol. 1.*
Smith, J. Russell. The Acclimatization of the Peach. Pp. 381-382.
American Inventor. Washington. Vol. 10.
Glass, E. J. Chinook Winds. Pp. 6-7.
Annuaire de la Société Météorologique de France. Paris. 50me Année.
Besson, Louis. La composante verticale du mouvement des nuages mesurée au néphoscope. Pp. 180-185.
Goutereau, Ch. Sur la durée de la pluie au Parc Saint-Maur. Pp. 186-189.
L'Aérophile. Paris. 10me Année.
Besancon, Georges. La catastrophe du "De Bradsky." Pp. 229-231.
Seux, Edmond. Aéronat à hélices multiples et à équilibre mécanique. Pp. 262-264.
Ciel et Terre. Bruxelles. 23me Année.
Birkeland, K. Sur la formation des nuages supérieurs. Pp. 387-397.
 — L'effet physiologique de la diminution de la pression de l'air. Pp. 409-412.
 — Influence de la quantité annuelle de pluie reçue par une contrée sur la marche de ses affaires. Pp. 412-413.
 — La température effective du soleil. P. 414.
 — Les pluies au Maroc. P. 414.
Luizet, M. Sur les perturbations périodiques de la température en juin et en décembre. Pp. 415-419.
Lancaster, A. La situation météorologique depuis avril. Pp. 431-434.
 — Les îles de la Frise allemande; le vent et la végétation. Pp. 439-440.
La Nature. Paris. 30me Année.
Libert, Lucien. Déformation solaires et rayon vert. Pp. 332-333.
Espitalier, G. Les expériences du "Méditerranéen" et les ascensions aéro-maritimes. Pp. 374-378.
Journal de Physique. Paris. 4me série. Tome 1.
Compan, Paul. Essai sur le pouvoir refroidissement de l'air et sur les lois du rayonnement. Pp. 708-716.
Comptes Rendus de l'Académie des Sciences. Paris. Tome 135.
Guillaume, J. Observations du soleil, faites à l'Observatoire de Lyon pendant le deuxième trimestre de 1902. Pp. 674-676.
Das Wetter. Berlin. 19 Jahrgang.
Bornstein, R. Die Verlegung des Wettertelegraphischen Dienstes auf eine frühere Stunde. Pp. 217-221.
Kassner, O. [arl]. Meteorologische Höhenstationen. Pp. 221-226.
 — Die zweite Versammlung der Beamten und Mitarbeiter des Weather Bureau im August 1901 in Milwaukee. Pp. 226-231.
Rimpau, W. Die Wirkung des Wetters auf die Zuckerrüben-Ernten der Jahre 1891 bis 1900. Pp. 232-238.
 — Kugelblitze. P. 239.
Illustrierte Aeronautische Mittheilungen. Strassburg. Oktober 1902.
Ebert, Hermann. Elektronen-Aspirationsapparat. Pp. 178-183.
 — Drachenversuche im Sommer 1902. P. 183.
 — Beobachtung der Anordnung von Cirruswolken. Pp. 183-194.
Gaea. Leipzig. 38 Jahrg.
 — Die deutsche Südpolar-Expedition. Pp. 755-757.
 — Die 35 jährige Periode der Klimaschwankungen. Pp. 760-761.
 — Eine interessante meteorologische Erscheinung. P. 761.
Physikalische Zeitschrift. Leipzig. 4 Jahrgang.
Julius, W. H. Eine Hypothese über die Natur der Sonnenprotuberanzen. Pp. 85-90.
Exner, I. F. Aus den Sitzungsprotokollen der luftelektrischen Kommission der Delegierten-Versammlung der kartellierten Akademien zu Göttingen. Pp. 90-93.
Ebert, H. Ueber die in München im Jahre 1901-1902 ausgeführten luftelektrischen Arbeiten. Pp. 93-95.
Elster, J. Ueber gemeinsam mit Herrn Geitel konstruierte transportable Apparate zur Bestimmung der Radio-aktivität der natürlichen Luft. Pp. 96-97.
Elster, J. Ueber gemeinsam mit Herrn Geitel ausgeführte Versuche über induzierte Radio-aktivität der atmosphärischen Luft durch positive Potentiale. P. 97.
Geitel, H. Ueber einige gemeinsam mit Herrn Elster angestellte Versuche über die elektrische Zerstreuung in der Luft. Pp. 97-99.
Goldhammer, D. A. Ueber die Transformation eines pulsierenden Stromes in einem Wechselstrom. Pp. 108-110.
Meteorologische Zeitschrift. Wien. Band 19.
Schneider, J. Die tägliche Bewegung der Luft über Hamburg. Pp. 393-399.
Polis, P. [eter]. Der Platzregen im mittleren Maas- und im Roergebiete vom 30 Juni, sowie die Dauerregen in Westdeutschland und Belgien vom 14 und 15 September 1901. Pp. 399-406.
Draenert, F. M. Weitere Beiträge zum Höhenklima des Staates Minas-Geraes, Brasilien. Pp. 406-423.
Lockyer, N., and Lockyer, W. J. S. Ueber einige Erscheinungen, welche auf eine kurze Periode von Sonnen- und meteorologischen Aenderungen schliessen lassen. Pp. 423-425.

- Fischer, L.** "Reifheizen" in Kärnten. P. 425.
Stentzel, A. Selbstleuchtende Nachtwolken. P. 425.
 — Halo zu Aachen vom 3 April 1902. P. 427.
 — Angot über Häufigkeit des Regens in Paris. P. 428.
Polis, P. Ergebnisse der Wind- und Gewitter-Beobachtungen zu Aachen 1873-1900. Pp. 429-430.
MacDowall, Alex. B. Temperatur und Regen. P. 430.
Halm, J. Eine neue Sonnentheorie. 430-435.
Rotch, A. L. Windmessungen zur See. Pp. 435-436.
 — Ueber die Ursache der jährlichen Periode der Polarlichter. Pp. 436-437.
Ward, R. DeC. Irisirende Wolken. Pp. 437-438.
Polis, P. Beiträge zur Kenntnis der Wolkengeschwindigkeit. I. Tägliche Periode der Wolkengeschwindigkeit. Pp. 441-453.
Koss, K. Kimmiefen-Beobachtungen. Pp. 453-459.
Brennecke, W. Ueber die Messung der Lufttemperatur auf dem Brocken. Pp. 459-463.
 — Heinrich Wild. P. 463.
Hellmann, G. Wolkenbruch in Berlin am 14 April 1902. Pp. 463-465.
Laska, W. Ueber die charakteristischen Zahlen der meteorologischen Elemente. Pp. 465-468.
Melander, G. Ueber die Absorption der Atmosphäre. Pp. 468-470.
 — Regenfall auf den Salomo-Inseln. Pp. 470-471.
 — Klima von Oxford. P. 471.
Danckelman, v. Resultate der meteorologischen Beobachtungen in Swakopmund im Jahre 1901. Pp. 471-473.
Satke, L. Häufigkeit und Stärke der Winde in Krakau. Pp. 473-474.
Hellmann, G. Intensität der Platzregen in Batavia. Pp. 474-475.
 — Die Barographenkurve während des Teifuns vom 2 to 3 August, 1901. P. 475.
Rosenthal, R. Schneefall am 18 Juli 1902 zu Irkutsk. Pp. 475-476.
Pockel, A. Beobachtungen des elektrischen Zerstreuungsvermögens der Atmosphäre und des Potentialgefälles im südlichen Algier und an der Küste von Tunis. Pp. 476-479.
Szalay, L. v. Ueber die Eigenthümlichkeit einzelner Blitze. Pp. 479-480.
 — Einige mittlere meteorologische Elemente für die Seychellen und Rodrigues. P. 480.
 — Resultate der meteorologischen Beobachtungen in der Umgebung der Kapstadt in verschiedenen Seehöhen. Pp. 480-482.
 — Bakteriengehalt der Luft auf dem Mont Blanc. Pp. 482-483.
 — Ben Nevis. P. 483.
Wesendonk, K. v. Zur Erklärung des Phänomens der blauen Sonne. Pp. 483-485.
 — Ueber wolkenbruchartige Regenfälle in Aachen. P. 485.
 — Meteorologische Beobachtungen im alten Königreich Kongo. Pp. 485-486.
 — Ergebnisse der Regenmessungen an der Station Kete-Kratyi (Togoland) in den Jahren 1898-1901. Pp. 486-487.
Wolfer, A. Provisorische Sonnenflecken-Relativzahlen für das III. Quartal 1902. P. 487.
Bollettino Mensuale, Società Meteorologica Italiana. Torino. Serie 2. Vol. 22.
Buti, Giuseppe. Applicazione del teorema di Carnot alla circolazione nell'atmosfera. Pp. 69-72.
Passerini, —. Sulla "pioggia di sangue" del 10 marzo 1901. Pp. 73-74.
Memorie della Società degli Spettroscopisti Italiani. Catania. Vol. 31.
Boccara, Vittorio E. La "Fata Morgana" studio storico scientifico con appendice bibliografica. Pp. 199-218.

THE RAINFALL OF AMOY, CHINA.

By JOHN H. FESLER, United States Consul, dated Amoy, October 25, 1902.

The autumn rice crop in this province bids fair to be almost an entire failure, owing to the extremely small amount of rain which has fallen.

The rainfall at this port, it is interesting to note, has shown a steady decrease for the past six years, as is shown in the following table:

Year.	Inches.
1897.....	57.75
1898.....	46.24
1899.....	43.61
1900.....	38.70
1901.....	36.28
1902 (first eight months).....	26.13

As the rainfall for the last four months of the year averages not to exceed 2 inches, the total for 1902 will probably be less than 30 inches.

Local observers ascribe this steady decline to a coincident decrease in the force of the southwest monsoon.

The theory, based on these facts, is that the failure in the monsoon is due to alterations in the Japan Current, and that these alterations in turn are caused by deep sea seismic disturbances, which have culminated in the numerous volcanic eruptions which have recently taken place in various parts of the world.

Whatever the cause, it is certain that the continued and increasing shortage of rainfall is lessening the productive power of this portion of China, and is causing much hardship and discontent.

[NOTE.—Such periods of small and large annual rainfall occur all over the world in succession and have to do with the general circulation of the atmosphere; earthquakes, ocean currents, etc., do not explain them. Changes in the amount and quality of the heat received from the sun, or of the heat radiated from the earth and the atmosphere, would affect the temperature and circulation of the atmosphere, and, therefore, the local rainfalls. An equally important factor is the internal mechanism of the atmosphere and the modifications of the general circulation that can occur within a limited range under a constant rate of radiation from the sun. These two sources of change in meteorological phenomena must be thoroughly investigated and evaluated before undertaking the study of such minor matters as the influence of earthquakes and ocean currents.—C. A.]

THE CIRCUMHORIZONTAL ARC.

By LOUIS BESSON, Paris, France, dated November 12, 1902.

In the MONTHLY WEATHER REVIEW for June, 1902, Vol. XXX, p. 317, there is reproduced a very interesting observation by Mr. J. A. Warren, of Santee, Nebr., who, on the 23d of June last, saw a rainbow arc parallel to the horizon at about 45° below the sun. In commenting upon this observation the Editor says that, so far as he knows, this is the first description of a horizontal circle tangent to the halo of 46° at its lowest point.

This particular tangential arc has a name in optical meteorology; it is called the circumhorizontal arc. In his "Note on halos," published in the *Annuaire Météorologique de France* for 1851, Bravais says that the theory of this arc is due to Galle; it is caused by the refraction of the light in the diedral angles of 90° at the lower base of the vertical prisms of ice, in the same way that the circumzenithal arc is due to the diedral angle of 90° at the upper edge of the same prisms. Theory indicates that this phenomenon only becomes apparent if the altitude of the sun is between 59° and 78°. I have not made the calculation but, judging from the latitude of the place, the date, and the hour, this condition seems to me to have been complied with at the time of Mr. Warren's observation. Was it really a circumhorizontal arc that was seen? This does not appear to me absolutely certain for the following reason. When the sun is very high in the sky the halo (of 46°) is very nearly parallel with the horizon, it would be absolutely so with a zenithal sun, and if an arc extending only a short distance from the lower part of this halo is seen, its parallelism with the horizon may seem to be perfect, especially if the arc is broad. Thus, according to the description given by the observer, the arc seen at Santee was very broad and quite short. It may then be asked if this was not merely the lower part of the circle of 46°?

In the note quoted above Bravais makes this remark: "The circumhorizontal arc is difficult to distinguish from the halo of 46° because the curves have the same direction and are near to each other." This difficulty must, indeed, be very great, if we may judge by the difficulty frequently experienced in distinguishing short and diffuse circumzenithal arcs from the halo of 46°, even although in this case the curves be in the contrary direction. It does not, therefore, seem to me to be possible to

consider the phenomenon of Santee as a certain and authenticated instance of the appearance of the circumhorizontal arc of Galle.

However this may be, it may be asked why it is that this arc is rarely or never seen, whereas the circumzenithal arc is relatively common. I have given an explanation, which I believe to be satisfactory, in a note entitled "The halo of April 5, 1899," and published in the *Annuaire of the Meteorological Society of France*, 47th year, 1899. According to my opinion the lower extremities of the ice prisms are not plane, but pointed, on account of the existence of oblique facets. Consequently, as the diedral angles of 90° necessary to the formation of the circumhorizontal arc do not exist, this phenomenon can not take place. The same hypothesis gives at one and the same time the explanation of the vertical orientation of the axes of the prisms, which latter is incomprehensible if we admit that these prisms are regular; their nearly vertical position is due to the fact that the resistance of the air is very small when the pointed end is turned toward the bottom.

NOTES AND EXTRACTS.

WEATHER BUREAU MEN AS INSTRUCTORS IN METEOROLOGY.

Mr. H. W. Richardson, Local Forecast Official at Duluth, Minn., states that on Tuesday, October 14, he began a series of seven weekly lectures to the pupils of the State Normal School at West Superior, Wis., on subjects that have been arranged so as to conform as nearly as practicable to the meteorological studies of the class in physiography. The addresses will be given in the large lecture room and to the entire school. The topics to be discussed are as follows:

(1) The Weather Bureau. (2) Meteorological instruments; theory, construction, and use. (3) Circulation of the atmosphere; pressure, temperature, winds, and precipitation. (4) Cyclones, hurricanes, thunderstorms, and tornadoes. (5) Cold waves, warm waves, frost, dew, etc. (6) The weather of the United States, with especial reference to the climate of Duluth and West Superior. (7) Weather maps and how to use them.

We understand that, as a preliminary arrangement, these lectures will be delivered with the aid of a few notes and that no formal papers have been prepared on the above subjects. We would, however, respectfully suggest that it would be well to reduce to writing such a systematic series of lectures by one of our oldest observers and give the newspapers or other publishers a chance to print and distribute for the benefit of a larger class of students.

Mr. James H. Scarr, Observer, Weather Bureau, Sacramento, Cal., has made arrangements to deliver a lecture on the Weather Bureau in that city.

Mr. J. Weeks, Observer, Weather Bureau, Macon, Ga., reports lecturing to a portion of the members of the class in physical geography in the High School in that city. The lecture will be repeated hereafter to the members of the class.

BACK NUMBERS OF THE MONTHLY WEATHER REVIEW.

The Editor is informed that the Library of the Royal Meteorological Society, Prince's Mansions, 70 Victoria street, London, S. W., desires to obtain the MONTHLY WEATHER REVIEW for March and April, 1875, in order to complete its set. As neither of these numbers can be furnished by the Central Office, the Editor would be glad to hear from any one who can supply them, or, possibly, the complete volume for 1875.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of H. H. Cousins, chemist to the Government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for October, 1902.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			Average.	1902.
	Per cent.		Inches.	Inches.
Northeastern division	25	21	13.87	7.41
Northern division	22	47	7.99	5.58
West-central division	26	21	14.13	10.91
Southern division	27	32	12.42	4.87
	100	120	12.10	7.19

The rainfall for the whole island was very much below the average. The heaviest fall recorded was 22.73 inches, at Troy, in the west-central division; the lowest was 1.12 inches, at Pedro Plains, in the southern division.

WATERSPOUT AT CAPE MAY, N. J.

Mr. H. A. McNally, Observer, Weather Bureau, reports that on October 7, 4:30 p. m., at Cape May, N. J., a low and ominous cloud was observed scudding over the ocean from southwest to northeast. At 4:44 p. m. a disturbance in the water slightly in advance of the front of the approaching cloud quickly developed into a cone, with its point uppermost and moved rapidly toward the southwest. In a very short time a similar cone, point downward, was seen on the lower surface of the cloud. In less than a minute the two points came in contact and an ideal hourglass formation was maintained for two or three minutes. The waterspout gradually became cylindrical and moved rapidly in the same direction as the cloud, but suddenly disappeared upward as though drawn up by suction. Rain was observed falling from the cloud as it advanced toward the northeast. The spout was distant about 5 miles and lasted six or seven minutes.

SEVERE HAILSTORM AT ST. LOUIS, MO.

The hailstorm at St. Louis, Mo., at 9:20 p. m., Sunday, October 12, was remarkable, not only because of its occurrence at night, but because of the size of the hailstones, the largest were certainly as large as hens' eggs, and, although it lasted but seven minutes, yet it was the worst hailstorm that has ever visited St. Louis. It covered an area extending from Tower Grove Park on the south to the fair grounds on the north and thence northwestward and southeastward to an unknown extent. The general progress of the storm as it approached from the west was foretold as to rain, but the hail seems to have been a local phenomenon. Dr. R. J. Hyatt, Local Forecast Official at St. Louis, says that the storm did not have the customary oval shape, but was of irregular formation and very jagged.

VOLCANIC AND ATMOSPHERIC PHENOMENA.

Mr. Hermann E. Hobbs, Observer, Weather Bureau, at St. Kitts, W. I., under date of October 24, writes as follows:

St. Kitts and Dominica.—Very little out of the ordinary occurred after the 8th of June, 1902, until the 4th of August, when at 7:57 p. m. there was a severe shock of earthquake. This shock, like the previous ones of recent date, was sharp and appeared to be vertical rather than horizontal in movement. There was another on August 17 at 6:16 p. m., slight; one on September 11 at 7:54 a. m., and one in the early morning of September 15 between 12 and 1 a. m. The heavier shocks were preceded by a preliminary rumbling noise. There have been no earthquakes since the last date.

On the evening of the eruption of August 30 there was a succession

of reports heard, lasting from 8:07 to 8:25 p. m. There was a slight trace of dust noticed falling at Basseterre, slightly more in Nevis, especially on the southeastern side about 15 miles from here, while in Montserrat enough fell to give a white appearance to the landscape. The dust cloud could be seen to the southeast and south, especially on the 2d of September. On the 3d of September the sunrise effect was very striking as the sun shone through the clouds of dust. There seem to have been an unusual number of days with light haze, but whether this was the effect of the dust clouds or the effect of aqueous vapor it is hard to decide. I am of the opinion that it was a combination of the two.

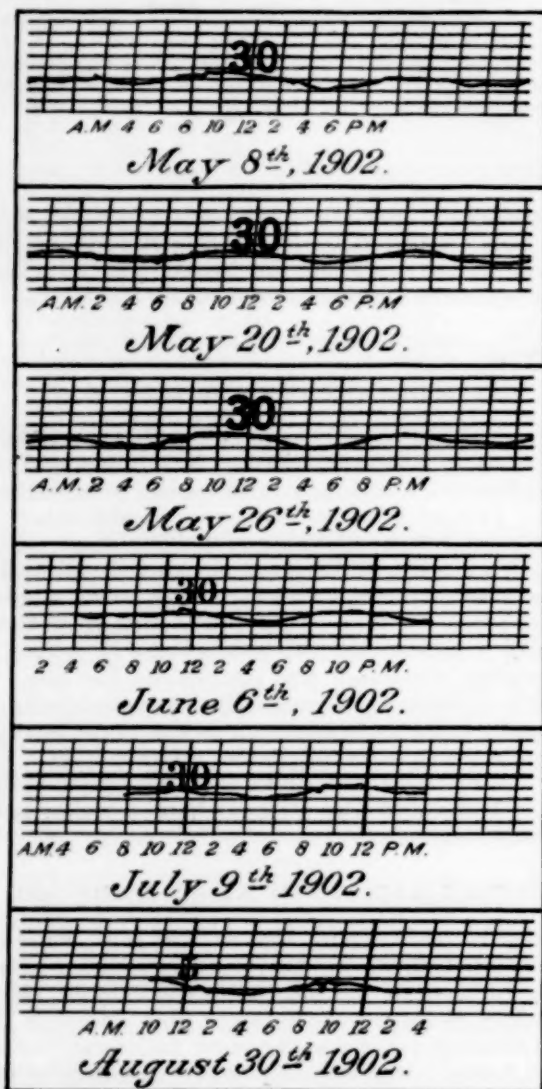


FIG. 1.

I have noticed that while the entire "hurricane season" has been marked by an almost entire absence of decided disturbances to the eastward, the direction of the upper clouds, when visible, has been continually shifting either to the northward or to the southward, usually the latter. The direction would swing around to about south-southeast and then return to normal. This has been repeated continually throughout the summer, occasionally varied by a swing through the northern quadrant.

It would appear as though there were some obstacle to the eastward which prevented the upper currents from flowing from that direction; may this not have been caused by the two columns of heated air rising from the scenes of the eruptions keeping the usual heated air layers stirred up and preventing the heated air from suddenly rising and thus starting a cyclonic disturbance?

I have also noticed that last summer (1901) the mercurial column in the sunshine recorder would often extend itself into the upper bulb, while this summer it has barely reached the contact wires on a great many days, especially in May, June, and July; even on clear days when no haze was visible this effect would be noticed.

I have the honor to enclose copies of the barograph sheets which were kindly loaned me by Mr. W. H. Porter, of Dominica, for the purpose of copying for the use of the Bureau. (See fig. 1.)

They are prints from photographic negatives taken from the original sheets on the days of the greatest eruptions and show quite distinctly the wave effect in the atmosphere.

San Juan.—Mr. E. C. Thompson, Section Director, San Juan, Porto Rico, W. I., reports that with the rainfalls of September 1 and 2 there fell an appreciable quantity of fine volcanic ashes at several stations on the island. One observer filtered 25 cuartillos of rain water and obtained about 5 gramos of ashes. This is supposed to have come from the eruption of August 30 on Martinique.

Turks Island.—Mr. D. Budge, General Station Superintendent for the Halifax and Bermuda Cable Company, at Halifax, N. S., writes: "Our agent at Turks Island reports that from the 29th of August to the 1st of September a heavy mist or haze has been observable around the island; it was so heavy on the 31st of August that the surrounding islands could barely be seen. The days were sunshiny and extremely hot. From what I hear it seems to be an unusual phenomenon here, and I report it as it may be of interest in view of the present volcanic eruptions in the West Indies."

Guatemala.—According to newspaper reports an eruption of the volcano Santa Maria in Guatemala began and continued until October 31 or later. This was a repetition of the eruptions in the same neighborhood in April and May. On October 26 there was a sudden and violent eruption of the volcano of Isalco 20 miles from Acajutla on the coast of San Salvador, after that volcano had been quiet for six months, but this eruption was short lived, whereas the flames, smoke, and ashes from Santa Maria produced widespread destruction. Santa Maria is between Retalhulen and Quezaltenango and in the neighborhood of the towns of San Felipe, Mazatenango, and Quezaltenango; its latitude is north 15° and longitude west 92°. Mount Pelee, on Martinique, is in latitude north 14° 50' and longitude 61° 20' west. The latter is, therefore, nearly 2,000 miles east of Santa Maria. The smoke and ashes from Santa Maria spread northwestward over Guatemala and Mexico, while those from Pelee and Soufriere spread first southwest, with the lower northeast trades, then easterly with the upper winds and again southwest as they descended into the lower trade.

ROBERT RUBENSON.

We regret to announce the death of Prof. Dr. Robert Rubenson, Director of the Central Meteorological Institute of Sweden on October 14, 1902, after a long illness. Professor Rubenson was born April 10, 1829, and was the author of many works on the climatology of Sweden. Among his earliest memoirs was his investigation of the polarization of blue sky light, and one of his latest was the complete record of ancient observations of auroras in Sweden.

CORRIGENDA.

In September Review for 1902, page 447, column 2, lines 26 and 29 from bottom for "day" read "hour." Line 22 from bottom for "2" read "20." Line 21 from bottom for "1500" read "150."

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR OCTOBER.

The temperature was above normal in daily values of $+0.2^{\circ}$ to $+3.4^{\circ}$ in all of the geographical districts except the south Pacific, where the departure averaged 0.5° per day below normal.

The precipitation was in excess of the normal in the Atlantic and east Gulf States, North Dakota, and the middle slope and

middle and south Pacific districts; in the remaining districts it was slightly deficient.

In the south Atlantic, Florida Peninsula, and southern slope districts the relative humidity was normal; below normal in New England, upper Lake, Plateau, and north Pacific districts, and above normal elsewhere.

The cloudiness was above the average in New England, south Atlantic, Florida Peninsula, east Gulf, lower Lake, middle slope,

and the Pacific districts; normal in the Ohio Valley and Tennessee, upper Mississippi Valley, and southern Plateau, and below the average in the remaining districts.

The pressure was above the normal in the Middle Atlantic, South Atlantic, and Gulf States, Ohio Valley and Tennessee, North Dakota, the slopes and middle and southern plateaus generally, and southern California.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart VI and the numerical values are given in Tables I and VI.

The mean barometer was highest from Arkansas and Louisiana eastward over the Gulf and South Atlantic States and northeastward over the Ohio Valley and Tennessee, lower lakes, Middle Atlantic States, and southern New England to the Atlantic Ocean; the crest, with readings slightly higher than 30.10 inches, overlying West Virginia and the mountain districts of Virginia, North Carolina, Tennessee, and Kentucky. The mean barometer was lowest over southeastern California and the extreme southwestern States, with a minimum reading of 29.85 at Yuma. The pressure diminished from that of September, 1902, in northeastern New York, New England, southern Florida, Washington, and western Oregon, with a maximum departure of $-.10$ inch in northeastern Maine; elsewhere it increased, and generally with higher values than in the districts where it had diminished, the greatest increases being over south-central Wyoming and thence southward.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England	8	51.1	+1.1	+3.8	+0.4
Middle Atlantic	12	57.7	+1.9	-2.4	-0.2
South Atlantic	10	66.6	+2.6	-5.0	-0.5
Florida Peninsula *	8	75.6	+2.6	-0.2	0.0
East Gulf	9	67.2	+0.4	+0.8	+0.1
West Gulf	7	68.4	+1.3	+5.4	+0.5
Ohio Valley and Tennessee	11	59.5	+2.5	-4.8	-0.5
Lower Lake	8	52.2	+0.9	-1.8	-0.2
Upper Lake	10	48.5	+1.6	+11.2	+1.1
North Dakota *	8	44.0	+0.2	+12.5	+1.2
Upper Mississippi Valley	11	56.0	+3.3	-2.4	-0.2
Missouri Valley	11	55.8	+3.2	+6.5	+0.6
Northern Slope	7	49.5	+3.4	+12.7	+1.3
Middle Slope	6	58.2	+2.9	+9.2	+0.9
Southern Slope *	6	64.9	+3.2	+10.6	+1.1
Southern Plateau *	13	59.8	+1.6	-0.7	-0.1
Middle Plateau *	9	49.4	+1.1	+1.8	+0.2
Northern Plateau *	12	51.5	+3.4	+5.4	+0.5
North Pacific	7	53.9	+2.1	+3.9	+0.4
Middle Pacific	5	50.2	+0.9	+0.6	+0.1
South Pacific	4	63.0	-0.5	-4.2	-0.4

* Regular and selected voluntary stations.

The trend of the isotherms of mean temperature differed from that of October, 1901, principally as follows: That of 50° lay somewhat to the southward and eastward, and most decidedly so over the Northern Slope; that of 75° lay considerably to the northward over the Florida Peninsula; that of 80° now appears in extreme southern Florida, but did not appear in October, 1901.

The isotherms of maximum temperature differed from those

63—3

of October, 1901, principally as follows: that of 90° embraced a more extensive region; that of 100° embraced a much smaller region than in 1901.

The isotherms of minimum temperature lay decidedly to the south of their position in October, 1901.

At regular Weather Bureau stations, temperatures were everywhere above normal, except in small areas on the middle Gulf coast, in central California and on the coast of southern California. On the other hand the voluntary stations show the temperature to have been about normal in Texas, Mississippi, Minnesota, and Alabama, and below normal in Oklahoma, Arkansas, Michigan, and South Carolina. These variations are most likely due to the use of averages based upon fewer years of record at many of the voluntary stations. The greatest departures from the mean daily normals were in Kansas, Nebraska, the Dakotas, Iowa, and Missouri, where they ranged from $+2^{\circ}$ to $+3^{\circ}$.

In Canada.—Prof. R. F. Stupart says:

The temperature was above the average from the Pacific coast to the western margin of the Lake Superior district by an amount varying from 0° to 4° . In the extreme eastern portion of Quebec and throughout the Maritime Provinces it was also above the average, and likewise to an amount varying from 0° to 4° . Elsewhere it was below the average, except over the western half of Lake Ontario and in the Niagara peninsula where there was a small positive departure. The chief negative departure, amounting to 3° , occurred between Lake Superior and the Ottawa Valley.

PRECIPITATION.

The precipitation was in excess of the normal generally in the Atlantic and Gulf States and west-central California, and in parts of the Missouri and upper Mississippi valleys, and middle slope regions, the greatest departure being over western Virginia where it amounted to over $+6.0$ inches. Where the precipitation was below the normal the changes were not particularly marked, except in scattered localities.

Some stations in Montana report the least precipitation in any October since the beginning of observations. In Pennsylvania the precipitation was unevenly distributed, being heavy in the southeastern part; and for the State as a whole it was the greatest in six years.

Snows occurred in North Carolina on the 28th; in the mountain districts of Idaho; in scattered localities and generally light in New York; on the 14th in parts of Pennsylvania, and throughout the State on the 28th and 29th; in scattered localities in North Dakota near the middle of the month, in amounts of from trace to 4 inches, and which melted rapidly.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England	8	4.43	116	+0.6	-1.4
Middle Atlantic	12	5.29	161	+2.0	-0.9
South Atlantic	10	4.11	105	-0.2	-11.7
Florida Peninsula *	8	7.21	150	+2.4	+0.3
East Gulf	9	3.75	132	+0.9	-9.7
West Gulf	7	2.56	90	-0.3	-7.0
Ohio Valley and Tennessee	11	2.09	81	-0.5	-7.6
Lower Lake	8	2.40	77	-0.7	+0.4
Upper Lake	10	2.34	77	-0.7	-2.8
North Dakota *	8	1.41	140	+0.4	+1.2
Upper Mississippi Valley	11	2.10	88	-0.3	+1.5
Missouri Valley	11	1.70	89	-0.2	+0.9
Northern Slope	7	0.53	64	-0.3	+0.2
Middle Slope	6	1.78	113	+0.2	+2.9
Southern Slope *	6	1.50	79	-0.4	+2.8
Southern Plateau *	13	0.21	30	-0.5	-1.9
Middle Plateau *	9	0.32	35	-0.6	-2.2
Northern Plateau *	12	0.58	45	-0.7	-1.7
North Pacific	7	2.92	59	-2.0	0.0
Middle Pacific	5	2.57	145	+0.8	+1.5
South Pacific	4	0.72	116	+0.1	-0.4

* Regular and selected voluntary stations.

In Canada.—Professor Stupart says:

The precipitation was above the average throughout Ontario and Quebec, except in a few isolated localities in the former province where there was a slight deficiency. Elsewhere in Canada it was below the average except very locally in Alberta and New Brunswick, the negative departures being very marked. In the Northwest Territories and Manitoba the precipitation for the month was extremely light, Winnipeg recording the largest amount, namely, one inch and two-tenths. Qu'Appelle had none, and Battleford, Prince Albert, and Swift Current one-tenth of an inch only. The deficiency in British Columbia varied from half an inch to several inches, while it was from half an inch to two inches over the greater portion of the Maritime Provinces. The chief positive departures occurred in eastern Ontario and over Quebec, where in some places the excess was over an inch.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 29. Arkansas, 12. California, 21, 22, 23, 24. Colorado, 10, 12. Connecticut, 9, 17. Idaho, 10, 28. Indiana, 12, 13, 16, 18, 20. Indian Territory, 12. Iowa, 1, 12, 13, 17, 18, 21, 25, 26, 27. Kansas, 3, 11, 12. Kentucky, 28, 29. Louisiana, 13. Maine, 26, 28, 29. Massachusetts, 12. Michigan, 7, 12, 14, 22, 26, 27, 28. Minnesota, 13, 21, 24, 25, 26, 27, 31. Missouri, 12, 17. Nebraska, 25. New Hampshire, 9, 22, 29. New Jersey, 18, 29, 30. New Mexico, 30. New York, 9, 14, 18, 19, 20, 21, 24, 28, 29, 30, 31. North Dakota, 9, 24, 25, 29. Ohio, 5, 13, 16, 17, 18, 22, 28, 29, 30. Oregon, 31. Pennsylvania, 13, 14, 17, 28, 30. South Dakota, 25. Tennessee, 13. Texas, 2, 19. Utah, 24. Virginia, 11. Washington, 31. Wisconsin, 14, 21, 27. Wyoming, 11, 18.

SLEET.

The following are the dates on which sleet fell in the respective States:

Colorado, 2, 11, 12, 22, 25, 30. Idaho, 25. Indiana, 12. Iowa, 13, 27. Kentucky, 28. Maine, 9, 25, 26, 29. Massachusetts, 26, 29. Michigan, 13, 14, 24, 27, 28. Minnesota, 12, 13, 24, 27. Montana, 12, 25. Nevada, 24. New York, 8, 17, 29, 30. North Dakota, 1, 12. Ohio, 14, 28, 29, 30. Pennsylvania, 14, 15, 17, 28, 29. Tennessee, 28. Wisconsin, 13, 14, 21, 22, 24, 25, 27. Wyoming, 12, 23, 24, 25, 31.

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	76	- 2	Missouri Valley	68	+ 3
Middle Atlantic	77	+ 3	Northern Slope	65	+ 7
South Atlantic	77	0	Middle Slope	65	+ 7
Florida Peninsula	80	0	Southern Slope	62	0
East Gulf	74	+ 2	Southern Plateau	37	- 8
West Gulf	75	+ 4	Middle Plateau	43	- 2
Ohio Valley and Tennessee	75	+ 5	Northern Plateau	60	- 2
Lower Lake	77	+ 4	North Pacific	82	- 3
Upper Lake	76	- 1	Middle Pacific	72	+ 1
North Dakota	72	+ 2	South Pacific	74	+ 5
Upper Mississippi Valley	73	+ 3			

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.6	+ 0.1	Missouri Valley	3.7	- 0.2
Middle Atlantic	4.6	- 0.2	Northern Slope	3.9	- 0.3
South Atlantic	4.2	+ 0.2	Middle Slope	3.6	+ 0.5
Florida Peninsula	5.4	+ 0.7	Southern Slope	2.6	- 0.2
East Gulf	4.4	+ 0.8	Southern Plateau	2.0	0.0
West Gulf	3.3	- 0.3	Middle Plateau	3.0	- 0.2
Ohio Valley and Tennessee	4.5	0.0	Northern Plateau	4.3	- 0.8
Lower Lake	6.2	+ 0.4	North Pacific	6.1	+ 0.2
Upper Lake	6.0	- 0.1	Middle Pacific	4.5	+ 1.3
North Dakota	4.7	- 0.4	South Pacific	3.6	+ 0.6
Upper Mississippi Valley	4.4	0.0			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I.	12	52	ne.	Mount Tamalpais, Cal. ..	31	56	nw.
Buffalo, N. Y.	13	62	w.	New Haven, Conn.	12	57	ne.
Do.	15	53	w.	New York, N. Y.	29	52	nw.
Do.	22	66	sw.	North Head, Wash.	27	51	se.
Do.	30	52	sw.	Do.	29	50	se.
Cape Henry, Va.	28	50	nw.	Port Reyes Light, Cal. ..	16	50	nw.
Chicago, Ill.	4	50	e.	Do.	21	60	se.
Do.	12	58	s.	Do.	22	65	se.
Eastport, Me.	28	50	s.	Do.	23	58	se.
Minneapolis, Minn.	30	58	nw.	Do.	31	50	nw.
Mount Tamalpais, Cal. ...	23	56	sw.	Syracuse, N. Y.	26	54	s.
Do.	24	50	sw.				

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 1,800 thunderstorms were received during the current month as against 1,218 in 1901 and 2,641 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 12th, 183; 13th, 149; 26th, 137.

Reports were most numerous from: New York, 183; Iowa, 136; Michigan, 126; Ohio, 114.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 13th to 21st.

In Canada: Thunderstorms were reported as follows: Grand Manan, 31; Yarmouth, 12, 19, 20, 31; Charlottetown, 8; Father Point, 6, 7, 19; Quebec, 6, 19; Ottawa, 6; Toronto, 5, 18, 24; White River, 26; Port Stanley, 5, 18, 23, 26; Parry Sound, 24, 26; Port Arthur, 10. An aurora was reported from Father Point on the 23d, and one from Minnedosa on the 31st.

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes.....	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (ins.).....	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages; it is prepared by the Forecast Division.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks

of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest barometric reading at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on pages 13-16 of the REVIEW for January, 1902. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900-1901, pp. 140-164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of Professor Bigelow's Report on the Barometry of the United States and Canada, which can be found in the Annual Report of the Chief of the Weather Bureau for 1900-1901, Volume II. The correction $t_0 - t$, temperature on the sea-level plane minus the station temperature, by Table 48 of the Barometry Report, is added to the observed surface temperature to obtain the adopted sea-level temperature. On account of excessive local abnormalities of temperature in the great California Valley, between the Coast Range and the Sierra Nevada Mountains, the stations in that valley have been ignored in drawing the lines of equal temperature.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States, prepared by the Forecast Division.

Chart VI.—Surface temperatures; maximum, minimum, and mean of these. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds, constructed as on Charts IV and VI.

TABLE I.—Climatological data for Weather Bureau Stations, October, 1902—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.										Precipitation, in inches.			Wind.					Total snowfall.									
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01 or more.	Total movement, miles.	Prevailing direction.		Maximum velocity.			Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.		
																									Miles per hour.	Direction.	Date.						
Upper Miss. Valley.																																	
Minneapolis	99	208		29.00	30.00	-.01	56.0	+.3	74	8	59	30	14	41	30				73	2.10	-.03											4.4	T.
St. Paul	837	102	122	29.00	30.00	-.01	50.0	+.2	74	8	59	32	14	42	31	43	38	72	1.40	-.04	11	8,697	se.	58	nw.	30	11	7	13				
La Crosse	714	71	87	29.26	30.03	-.01	51.9	+.4	74	10	62	32	14	42	31				1.33	-.06	11	5,170	se.	32	nw.	30	13	8	10	4.8			
Davenport	606	71	79	29.36	30.00	-.04	55.8	+.3	78	25	65	33	14	46	29	49	44	74	1.35	-.09	4	5,641	s.	28	nw.	26	9	14	8	5.2			
Des Moines	861	84	88	29.10	30.03	-.00	55.4	+.3	77	22	65	31	14	45	30	49	45	75	2.81	+.02	7	5,525	w.	30	s.	18	13	11	7	4.3			
Dubuque	698	100	117	29.27	30.03	-.01	53.5	+.2	77	22	63	30	14	44	32	46	42	71	3.70	+.07	8	6,204	sw.	42	sw.	25	11	12	8	4.9			
Keokuk	614	63	78	29.35	30.00	-.05	58.0	+.3	80	25	68	32	14	48	31	51	48	79	2.26	-.04	7	4,896	se.	24	w.	27	10	8	13	6.1			
Calro	356	87	93	29.70	30.07	-.00	62.4	+.3	80	19	72	39	29	53	29	54	50	72	2.38	-.04	8	5,396	sw.	30	w.	12	22	2	7	3.0			
Springfield, Ill.	644	82	93	29.35	30.04	-.01	58.0	+.3	78	22	68	34	14	48	30	50	46	72	0.79	-.20	4	4,678	s.	28	s.	12	13	12	6	4.2			
Hannibal	534	75	110	29.45	30.03	-.02	58.7	+.3	82	25	70	30	14	48	32				2.15	-.06	9	6,471	sw.	37	se.	12	15	7	9	4.0			
St. Louis	567	111	210	29.43	30.03	-.03	62.2	+.7	82	24	71	38	14	53	32	53	48	68	2.94	+.15	7	6,627	sw.	32	nw.	27	14	12	5	4.2			
Missouri Valley.																																	
Columbia	784	11	84	29.18	30.01	-.04	59.5	+.1	82	25	71	28	14	48	37				2.00	-.09	7	5,819	s.	29	w.	17	17	8	6	3.7			
Kansas City	963	78	95	29.00	30.04	-.00	61.0	+.3	82	23	70	36	28	52	32	52	47	68	1.70	-.02													
Springfield, Mo.	1,324	98	104	28.64	30.05	-.00	60.2	+.2	80	16	70	35	28	50	32	52	48	73	2.52	+.04	8	5,790	s.	25	nw.	12	19	6	6	3.5			
Topeka	81	89					59.6	+.6	82	23	71	32	28	48	34				2.49	-.09	8	6,419	s.	27	s.	23	21	6	4	2.6			
Lincoln	1,189	75	84	28.72	29.98	-.05	57.2	+.3	83	23	68	29	28	46	38	49	44	71	3.04	0.0	8	7,668	se.	36	sw.	12	22	5	4	2.7			
Omaha	1,105	115	121	28.81	30.00	-.03	57.6	+.7	82	22	67	32	28	48	30	49	43	66	2.26	+.03	5	6,805	s.	30	s.	25	16	11	4	3.4			
Valentine	2,598	47	54	27.26	29.99	-.02	50.2	+.1	84	21	67	20	28	34	54	40	33	64	0.39	-.05	5	6,469	w.	35	s.	30	20	7	4	3.2			
Sioux City	1,135	96	164	28.78	30.00	-.02	54.5	+.5	80	23	65	27	28	44	44				2.13	-.03	4	5,818	sw.	30	n.	6	14	8	9	4.6			
Pierre	1,572	43	50	28.33	30.00	-.01	51.2	+.8	82	5	66	25	28	37	47	41	35	65	0.39	-.05	5	6,469	w.	35	s.	30	20	7	4	3.2			
Huron	1,306	56	67	28.60	30.02	+.01	48.9	+.4	81	5	64	20	28	34	52	41	34	68	0.63	-.11	2	4,195	nw.	38	nw.	30	19	6	6	3.6			
Yankton	1,233	42	49	28.68	30.00	-.01	48.3	+.1	81	21	67	25	28	40	48				0.50	-.02	6	6,797	nw.	28	s.	30	16	10	5	4.1			
Northern Slope.																																	
Havre	2,505	46	53	27.35	30.00	+.02	47.6	+.6	80	4	62	17	27	34	50	41	36	73	1.76	-.03	4	5,301	w.	44	sw.	28	16	12	3	3.9			
Miles City	2,371	42	50	27.47	30.00	-.00	50.0	+.3	80	7	64	24	26	36	46	44	41	89	0.24	-.04	2	3,094	nw.	30	sw.	29	19	10	2	3.4			
Helena	4,110	88	94	25.83	30.04	+.01	49.4	+.2	75	5	59	28	25	39	33	39	29	50	0.10	-.08	3	4,873	sw.	30	sw.	15	7	12	12	5.9			
Kalispell	2,965	45	51	26.96	30.03	+.02	46.2	+.2	71	7	58	27	23	34	36	40	35	73	0.21	-.06	2	3,424	w.	24	sw.	28	11	13	7	4.4			
Rapid City	3,234	46	50	26.62	30.00	-.01	51.0	+.2	78	7	64	24	13	38	42	41	32	56	0.16	-.02	2	5,316	w.	30	nw.	18	25	3	3	2.0			
Cheyenne	6,088	56	64	24.06	30.04	+.03	47.8	+.2	77	8	61	26	3	35	39	37	28	53	0.21	-.04	4	6,232	nw.	30	w.	25	11	10	10	4.6			
Lander	5,372	26	36	24.69	30.09	+.05	46.2	+.2	75	7	62	21	30	30	46	36	29	62	0.52	-.02	3	1,947	sw.	24	sw.	23	14	16	1	3.2			
North Platte	2,821	43	52	27.10	30.02	-.00	54.3	+.5	84	8	68	29	28	41	43	45	41	72	1.10	+.01	3	4,540	w.	24	nw.	25	17	10	4	4.0			
Middle Slope.																																	
Denver	5,291	79	151	24.78	30.04	+.03	53.0	+.5	81	8	66	31	28	40	43	41	30	51	1.32	+.03	6	4,540	w.	24	nw.	25	17	10	4	4.0			
Pueblo	4,685	80	86	25.32	30.01	+.01	53.4	+.2	84	8	69	29	28	38	48	41	31	49	0.80	-.01	6	5,215	s.	36	nw.	25	16	10	5	4.2			
Concordia	1,398	42	47	28.53	30.02	-.01	58.8	+.3	83	7	70	28	28	47	35	51	48	79	0.44	-.03	3	4,293	nw.	42	nw.	25	15	14	2	3.9			
Dodge	2,509	44	54	27.40	30.00	-.02	59.7	+.6	89	24	74	31	28	45	42	48	44	70	3.25	+.11	5	5,427	s.	24	s.	22	15	11	5	3.8			
Wichita	1,358	78	85	28.60	30.03	-.00	61.2	+.6	83	24	73	33	28	50	34	52	48	71	2.26	+.10	3	7,732	s.	40	s.	22	18	11	2	3.4			
Oklahoma	1,214	79	86	28.74	30.02	-.01	63.0	+.1	84	12	74	39	5	52	31	54	50	71	2.02	-.04	4	6,634	s.	29	nw.	3	22	3	6	2.9			
Southern Slope.																																	
Abilene	1,738	45	54	28.21	30.00	-.01	66.6	+.1	87	18	78	43	4	56	36	56	51	67	1.90	-.02	3	8,777	s.	36	s.	29	20	6	5	3.1			
Amarillo	3,676	43	52	26.27	29.97	-.03	60.2	+.0	86	24	74	34	4	47	36	47	39	58	0.80	-.01	5	6,224	se.	26	se.	30	23	4	4	2.3			
Southern Plateau.																																	
El Paso	3,762	10	110	26.20	29.93	+.01	65.7	+.7	88	17	81	42	6	50	41	50	38	46	1.74	+.01	3	9,537	s.	34	nw								

TABLE II.—Climatological record of voluntary and other cooperating observers, October, 1902.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Alabama.</i>	°	°	°	Inch.	Inch.
Ashville	84	31	61.1	4.28	
Benton				3.28	
Bermuda	90	35	64.4	1.42	
Birmingham	88	36	63.1	4.60	
Bridgeport				3.43	
Burkeville				3.45	
Calera				3.47	
Camphill	85	35	61.6	2.33	
Citronelle	87	40	67.4	6.53	
Clanton	83	30	60.4	5.13	
Cordova	85	27	65.7	2.50	
Daphne	90	39	66.8	4.53	
Decatur	88	37	63.9	3.07	
Demopolis				5.03	
Dothan	89	40	67.0	3.34	
Eufaula	87	36	65.0	4.92	
Evergreen	88	37	65.4	2.30	
Flomaton	88	35	65.2	3.20	
Florence				2.13	
Florence	84	30	63.2	2.05	
Fort Deposit	89	39	63.7	3.90	
Gadsden	88	31	63.3	3.34	
Goodwater	86	32	62.8	2.53	
Greensboro	89	38	64.4	5.90	
Hamilton	84	29	60.4	1.65	
Helena				3.33	
Highland Home	88	40	66.0	2.42	
Letohatchie				3.88	
Livingston	90	29	64.5	3.50	
Lock No. 4	87	33	62.6	3.25	
Madison Station	85	30	63.2	3.70	
Maple Grove	88	28	60.4	3.98	
Marion	85	36	63.0	5.31	
Newbern	91	34	63.6	6.10	
Newburg	85	28	61.2	2.44	
Notasulga				4.74	
Oneonta	84	28	60.7	2.56	
Opelika	83	37	62.6	8.18	
Ozark	89	39	65.7	3.23	
Prattville	87	31	63.4	3.24	
Pushmataha	95	33	63.6	4.10	
Riverton	84	30	61.1	1.39	
Scottsboro	83	32	59.2	3.68	
Selma	89	36	64.0	5.73	
Talladega	84	31	63.0	2.10	
Thomasville	90	37	62.9	2.90	
Tuscaloosa	89	34	63.0	2.72	
Tuscumbia	84	34	61.2	1.68	
Tuskegee	90	38	67.1	3.73	
Union Springs	84	38	64.2	8.65	
Uniontown	88	36	65.8	1.84	
Valleyhead	85	27	62.4	4.00	
Verdena				5.09	
Wetumpka	89	34	66.6	3.10	
<i>Alaska.</i>					
Juneau	65	31	45.7	6.57	
Killisnoo	57	32	43.6	4.60	
Sitka	50	32	47.2	8.25	
<i>Arizona.</i>					
Allaire Ranch				0.40	
Arizona Canal Co's Dam	95	55	75.4	0.00	
Axtec	101	58	83.7	0.00	
Benson	88	47	69.6	T.	
Bisbee	83	47	64.8	0.30	
Buckeye	98	43	69.5	0.00	
Casagrande	89	60	74.2	0.00	
Champer Camp	103	41	70.9	0.10	
Cochise	84	50	65.8	0.00	
Congress	88	55	71.7	0.00	
Dragoon Summit	82	50	64.0	0.70	
Dudleyville	96	39	68.7	0.24	
Duncan	97	28	60.4	0.10	
Fort Apache	83	30	56.2	0.30	
Fort Defiance	76	22	46.5	0.50	
Fort Grant	85	41	63.4	0.90	
Fort Huachuca	87	52	70.6	0.10	
Globe	89	45	65.5	0.20	
Jerome	82	47	65.2	0.00	
Maricopa	98	60	74.1	0.01	
Mesa	97	45	71.8	0.25	
Mesa (near)	98	44	71.8	0.00	
Mohawk Summit	99	60	74.8	0.00	
Mount Huachuca	84	43	65.5	0.61	
Natural Bridge				0.00	
Nogales	91	40	66.5	0.21	
Oracle	84	48	67.5	0.13	
Oro				0.04	
Phoenix	99	44	72.1	0.06	
Pima	93	35	65.8	0.05	
Pinal Ranch				0.06	
Prescott	89	26	54.3	0.00	
Sentinel	97	60	77.6	0.00	
Signal	100	40	69.2	0.00	
Superstition				0.01	
Taylor	85	25	54.2	0.00	
ombstone	88	48	67.6	0.11	
onto	94	39	66.8	0.33	
ucson	95	43	71.0	1.64	
<i>Arizona—Cont'd.</i>					
Vail	90	63	75.2	0.25	
Walnut Grove				0.05	
<i>Arkansas.</i>					
Aleo	84	36	61.4	1.17	
Amity	82	34	60.4	2.23	
Arkadelphia	90	35	64.7	1.56	
Arkansas City				2.55	
Batesville	89	32	63.2	1.32	
Beebranch	86	33	62.2	1.40	
Blanchard	84	35	62.3	5.36	
Brinkley	85	33	62.2	3.84	
Camden				2.75	
Camden	84	38	65.0	2.74	
Conway	85	34	63.8	1.95	
Conway	84	30	60.2	1.59	
Dallas	80	37	62.2	2.65	
Dardanelle				1.87	
De Queen	90	39	64.2	2.70	
Dutton	89	36	59.8	4.88	
Eureka Springs	89	35	62.2	3.76	
Fayetteville	87	34	60.7	4.84	
Forrest City	85	35	62.6	4.71	
Fulton				1.06	
Hardy	84	34	61.6	1.59	
Helena				2.38	
Helena	86	35	63.3	2.03	
Jonesboro	85	30	62.8	2.81	
Lacrosse	85	36	62.0	1.53	
Lake Village	87	37	63.8	2.10	
Lonoke	84	31	61.7	1.95	
Lutherville	87	33	62.8	1.61	
Malvern	88	34	63.0	2.85	
Marianna	82	33	62.1	3.66	
Marvell	87	36	64.1	3.04	
Mountain Home	88	32	61.0	2.29	
Mount Nebo	78	42	61.7	0.88	
New Gascony	88	33	63.6	7.10	
Newport				1.78	
Newport	84	31	60.6	1.90	
Newport	83	30	61.4	1.89	
Oregon	86	32	60.3	2.55	
Ozark	88	41	65.0	2.70	
Perry	81	31	61.2	1.11	
Pinebluff	85	33	62.7	2.99	
Pocahontas	85	29	61.3	2.27	
Pond	84	29	60.5	2.52	
Prescott	89	47	67.8	1.99	
Princeton	87	33	63.1	2.79	
Rison	80	31	63.3	2.89	
Rosadale	85	40	65.0	1.79	
Russellville	84	35	61.6	1.75	
Silversprings	84	34	60.9	2.54	
Spittsville	86	35	63.4	1.43	
Stuttgart	86	33	62.0	4.85	
Texarkana	87	41	64.3	1.46	
Warren	86	34	63.0	5.49	
Washington	81	41	63.2	2.64	
Wiggs	83	31	59.2	2.48	
Winchester	89	32	63.0	1.88	
Winstow	78	37	59.8	4.92	
Witts Springs	80	37	60.8	1.44	
<i>California.</i>					
Angiola	95	37	62.2	0.00	
Azuza	87	47	65.0	0.41	
Bakersfield				0.35	
Ballast Point L. H.				0.09	
Berkeley	80	47	59.0	2.35	
Bishop	88	28	55.0	0.28	
Bodie	79	—	35.2	0.58	
Bowman	72	32	49.8	5.86	
Branscomb				5.88	
Campbell	87	39	58.6	1.35	
Campo				0.03	
Cape Mendocino L. H.				3.40	
Cedarville	83	22	49.2	0.31	
Chico				2.11	
Cisco	68	29	42.4	6.70	
Claremont	89	41	61.4	0.37	
Cloverdale	87	40	60.4	6.22	
Colusa	85	44	61.4	1.57	
Corning	85	48	65.4	2.45	
Coronado	77	55	64.4	0.06	
Crescent City	80	39	54.6	4.29	
Crescent City L. H.				4.21	
Cuyamaca				1.01	
Delano	89	57	70.1	0.39	
Delta	87	32	55.7	4.57	
Dunnigan	87	45	63.0	2.79	
Durham	86	45	61.7	1.85	
East Brother L. H.				1.40	
Edmonton	77	34	48.6	4.31	
El Cajon	89	42	63.6	0.20	
Elmdale	93	39	62.4	0.39	
Elsinore	98	42	65.8	0.13	
Escondido	89	37	61.0	0.28	
Fallbrook	84	42	61.0	0.29	
Folsom	90	48	61.8	1.85	
Fordey Dam				5.46	
<i>California—Cont'd.</i>					
Fort Bragg				2.90	
Fort Ross	78	50	62.6	8.95	
Foster				0.68	
Georgetown	83	40	58.6	3.77	
Gilroy (near)	93	39	60.9	0.81	
Goshen	85	45	63.8	0.00	
Grass Valley				4.04	
Greenville				3.79	
Hanford	94	39	62.6	0.36	
Healdsburg	93	33	59.4	6.10	
Hollister	90	37	60.0	0.31	
Humboldt L. H.				3.45	
Idylwild	80	27	54.0	0.10	
Imperial	98	50	74.2	0.00	
Indio	98	60	75.8	0.00	
Iowa Hill	80	43	57.4	3.09	
Irvine	80	50	66.4	0.35	
Jackson	78	45	60.6	2.46	
Jolon				0.60	
Kennedy Gold Mine	79	40	56.4	2.71	
Kent	82	41	59.2	5.94	
Kernville				0.16	
Kono Tayee	78	46	59.6	3.92	
Laguna Valley				0.48	
Lamesa				0.30	
Laporte	68	35	45.2	6.94	
Las Fuentes Ranch				1.01	
Legrande	90	40	62.5	0.50	
Lemoncove	93	42	67.7	0.51	
Lick Observatory	73	40	53.0	2.05	
Lime Point L. H.				2.05	
Livermore	92	41	61.8	0.47	
Lodi	88	40	60.0	0.66	
Los Gatos	86	42	59.5	2.80	
Manzana	88	40	62.8	0.03	
Mare Island L. H.				1.91	
Merced	92	38	63.0	T.	
Mercury	86	46	61.6	7.51	
Milo				1.10	
Milton (near)	87	49	63.7	1.11	
Modesto	90	50	66.3	0.40	
Mohave	85	42	62.2	T.	
Mokelumne Hill	72	42	56.7	2.22	
Monterio	80	40	61.0	0.10	
Monterey	80	44	62.4	0.50	
Mount St. Helena				7.92	
Napa	97	40	61.8	4.84	
Needles	94	52	73.4	0.00	
Nevada	86	34	55.2	3.95	
Newhall	94	50	62.5	0.82	
Newman	87	42	63.8	0.61	
Niles	86	42	60.6	1.06	
North Bloomfield	85	34	55.4	4.43	
North Ontario	88	44	62.8	0.41	
North San Juan	80	43	61.0	3.77	
Oakland	78	47	60.2	1.80	
Ogilby	104	70	82.2	0.00	
Orland	90	50	68.4	2.66	
Palermo	88	37	60.1	2.43	
Paso Robles	93	32	56.6	1.08	
Peachland	84	43	59.9	6.29	
Piedras Blancas L. H.				1.58	
Pigeon Point L. H.				0	

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Temperature. (Fahrenheit.)					Precipitation.		Temperature. (Fahrenheit.)					Precipitation.		Temperature. (Fahrenheit.)					Precipitation.					
Stations.			Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.			Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.			Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
California—Cont'd.							Colorado—Cont'd.							Georgia—Cont'd.										
San Luis L. H.	77	50	62.4	1.85		2.14		Sapinero	79	26	52.0	0.77		8.0		Allapaha	88	37	66.7	2.46				
San Mateo *1	86	42	61.2	0.55				Selbert	79	26	52.0	0.77				Alpharetta	83	31	61.2	1.19				
San Miguel *1	70	50	59.8	1.18				Silt	68	22	44.5	1.33				Americus	88	38	64.1	4.89				
San Miguel Island	80	50	61.8	1.48				Sugarloaf	76	30	52.4	0.52				Athens	82	39	62.0	1.55				
Santa Barbara				1.13				Trinidad				0.28		5.8		Bainbridge	85	38	65.5	3.35				
Santa Barbara L. H.				1.12				Twinlakes				1.88				Blakely	85	42	67.0	3.40				
Santa Clara	82	40	58.0	2.10				Vilas				2.00				Bowersville	83	35	62.1	3.21				
Santa Cruz				1.82				Walley				1.16		11.0		Brent	85	35	64.9	4.65				
Santa Cruz L. H.				1.02				Westcliffe	70	19	44.4	1.36		11.6		Butler				3.89				
Santa Maria	87	42	62.2	0.60				Whitepine	62	13	36.5	1.05				Camak	84	36	63.4	3.69				
Santa Monica	71	43	58.2	T.				Wray	83	28	53.0	0.78				Canton				2.18				
Santa Paula	83	47	62.7	3.70				Yuma				0.78				Carlton				2.48				
Santa Rosa	90	34	58.6	6.55				Connecticut																
Shasta	89	42	63.4	0.56				Bridgeport	76	28	54.4	7.67	T.			Clayton	76	28	57.2	3.08				
Sierra Madre	82	48	62.8	2.05				Canton	71	20	49.8	6.11	T.			Columbus	83	43	65.4	5.42				
S. E. Farallone L. H.				0.66				Colchester	73	25	53.2	5.78	T.			Covington	88	35	63.6	3.14				
Stockton	84	44	66.6	0.35				Falls Village				4.96				Dahlonega	80	33	61.3	1.95				
Storey	90	35	61.0	4.85				Hartford a.	72	25	50.8	6.71	T.			Diamond	82	31	58.0	0.95				
Summerville	75	31	52.6	0.78				Hartford b.	71	30	52.0	7.72	T.			Douglas	91	37	67.9	4.10				
Susanville	73	27	49.8	1.84				Hawleyville	71	24	52.0	6.33	T.			Dudley	85	36	65.8	3.56				
Tehama *1	85	51	65.2	0.20				Lake Konomoc				5.93				Eastman	89	39	66.8	5.68				
Tejon Ranch	87	42	63.4	2.66				New London	72	31	53.5	4.21	T.			Elberton	83	36	62.5	2.60				
Trinidad L. H.				0.50				North Grosvenor Dale	76	22	50.6	5.66	T.			Experiment	82	36	62.8	3.53				
Truckee *1	68	24	39.0	0.29				Norwalk	73	25	52.2	7.64	T.			Fitzgerald	93	38	66.9	4.79				
Tulare b.				0.24				Southington	76	23	52.0	6.10	T.			Fleming	89	38	68.0	6.45				
Tulare c.	96	38	63.8	0.24				South Manchester				5.58				Fort Gaines	90	38	65.3	4.02				
Tustin	79	52	67.8	3.60				Storrs	71	25	50.3	5.68	T.			Gainesville	80	36	61.2	3.26				
Ukiah	92	32	58.0	7.94				Voluntown	78	20	53.6	4.67				Gillsville	83	34	61.9	2.17				
Upperville	89	34	57.6	3.53				Wallingford				6.95				Greensboro	87	33	63.2	3.57				
Upper Mattole *1	81	37	52.5	0.45				Waterbury	76	24	52.8	6.19	T.			Griffin	88	36	64.5	3.63				
Vacaville *1	90	46	62.1	0.64				West Cornwall	72	24	50.2	5.42	T.			Harrison	87	38	65.0	2.39				
Ventura	77	48	62.2	0.00				West Simsbury				6.15				Hawkinsville	87	34	64.5	5.32				
Visalia	92	34	61.8	0.25				Delaware																
Volcano *1	105	58	75.2	3.55				Milford	84	29	60.6	4.02	T.			Jesup	90	40	69.2	5.02				
Wasco	91	43	63.7	2.00				Millsboro	81	27	59.8	2.98				Lost Mountain	86	35	63.0	0.92				
Westpoint				1.44				Newark	76	28	55.7	8.33				Louisville	83	37	64.6	3.80				
Wheatland	86	41	60.9	5.55				Seaford	79	31	60.2	4.23				Lumpkin	88	37	65.7	2.96				
Williams *1	87	48	65.5	2.20				District of Columbia																
Willits	86	32	56.4	1.10				Distributing Reservoir *5	76	39	58.8	6.23				Marshallville	86	38	66.3	4.45				
Willows	85	40	60.8	2.17				Receiving Reservoir *5	78	34	60.2	7.31				Mauzy	91	37	68.0	1.20				
Yerba Buena L. H.				4.66				West Washington	83	28	58.0	7.03				Milledgeville	85	37	64.0	5.14				
Yuba City *3	88	46	65.0					Florida																
Zenia								Archer	89	45	72.4	2.27				Millen	93			5.46				
Colorado															Monticello	88	36	64.8	3.37					
Alford	77	26	47.3	0.83	T.			Avon Park	94	54	77.4	7.77				Morgan				2.05				
Ashcroft	69	15	39.6	1.63	4.0			Bartow	96	54	78.2	7.16				Naylor	92	37	70.2	3.92				
Blaine	90	30	56.9	1.53	1.2			Bonifay	90	38	69.2	1.93				Newnan	82	35	61.1	4.71				
Boulder	78	33	55.0	1.44	0.5			Brooksville	95	48	75.4	3.12				Oakdale				1.80				
Boxelder				0.91				Carrabelle	87	44	71.2	3.77				Point Peter	85	33	61.4	2.10				
Breckenridge	64	14	36.5	0.78	10.7			Clermont	95	50	77.1	3.78				Poulan	89	35	66.0	3.68				
Buenavista				0.50	5.0			De Funiak Springs	90	39	67.8	4.34				Putnam	90	35	65.2	4.50				
Canyon	83	28	54.0	0.34				Deland	89	48	74.2					Quitman	90	38	67.6	4.08				
Castlerock	78	21	49.7	0.80				Eustis	95	49	76.8	6.28				Ramsey	83	30	61.3	1.32				
Cedarvale	80	27	51.9	0.40				Federal Point	90	51	74.0	6.97				Resaca				2.47				
Cheesman				0.24				Fernandina	90	48	72.6	10.09				Rome	86	32	61.4	2.79				
Cheyenne Wells	90	30	55.0	1.32				Flamingo	92	61	81.5	5.30				St. Marys	89	44	71.5	10.00				
Clearview	70	16	43.4	0.52	8.0			Fort George	86	50	73.8					Statesboro	89	40	67.6	6.78				
Collbran	78	23	49.2	0.85				Fort Meade	95	49	77.3	9.37				Stillmore	90	37	66.2	5.07				
Colorado Springs	75	28	50.2	0.51	T.			Fort Myers	89	56	76.6	7.46				Talbotton	88	35	64.5	4.40				
Delta	84	20	50.0	0.25				Fort Pierce	95	58	77.6	11.37				Tallapoosa	86	28	61.6	1.15				
Durango	77	25	50.2	0.92				Gainesville	90	46	73.6	3.30				Thomasville	90	41	68.9	4.15				
Fort Collins	80	26	48.8	1.15				Holt	89	38	65.8	0.98				Tooea	92	36	61.4	3.08				
Fort Morgan	77	29	50.6	1.04				Huntington	92	48	74.6	5.73				Valona	80	44	68.2	14.27				
Fox	84	26	52.1	1.17				Hypoluxo	94	60	79.2	18.99				Vidalia	90	40	67.2	2.96				
Garnett	72	11	42.0	0.16				Inverness	91	49	73.8	3.45				Washington	83	40	63.2	3.87				
Gilman				1.69	1																			

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.		Stations.	Temperature. (Fahrenheit.)			Precipitation.		Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.						Indiana—Cont'd.						Iowa—Cont'd.					
Alexander	79	30	58.0	2.29		Farmland	77	31	56.4	2.76		Dows	74	27	50.9	0.95	
Antioch	75	27	51.7	3.67		Fort Wayne	78	28	54.9	4.28		Earham	77	26	52.6	3.71	
Ashton	75	28	52.7	4.18		Franklin	78	33	56.3	3.02		Eldon	80	30	55.9	4.38	
Astoria	78	31	55.4	2.77		Greencastle	75	34	57.2	2.20		Elkader	80	27	53.4	1.87	
Aurora	78	30	53.2	2.02		Greensburg	81	26	56.0	2.60		Emerson				0.50	
Benton	91	31	63.0	0.96		Hammond	77	33	53.8	2.06		Fairfield	79	28	55.4	4.71	
Bloomington	82	29	57.6	2.70		Hector	79	33	55.4	2.19		Fayette	75	23	50.2	1.47	
Cambridge	77	31	54.5	4.19		Holland	83	28	60.4	3.27		Fertile	77	27	50.6	1.69	
Carlinville	50	30	57.8	3.06		Huntington	75	32	54.8	4.21		Forest City	76	26	50.9	1.32	
Carrollton	78	34	58.6	2.36		Jeffersonville	81	35	60.1	1.42		Fort Madison	74			3.51	
Centralia	93	27	63.0	1.10		Kokomo	78	31	56.0	2.13		Galva				1.06	
Charleston	79	32	58.8	1.99		Lafayette	76	24	56.1	3.27		Gilman				2.91	
Chester				1.41		Laporte	79	32	54.6	1.38		Grand Meadow	74	27	50.7	1.33	
Cisne	85	24	59.9	0.76		Logansport	78	33	55.3	2.65		Greene	75	29	51.4	1.39	
Coatsburg	80	29	56.8	2.21		Madison a	89	31	59.4	2.13		Greenfield	77	26	54.2	2.91	
Cobden	84	30	62.4	0.84		Madison b				2.58		Grinnell	75	29	53.2	3.60	
Decatur	79	27	57.2	2.08		Marengo	82	29	57.3	3.71		Grinnell (near)	77	27	53.9	4.55	
Dixon	88	31	53.6	3.90		Marion	78	28	55.6	2.03		Grundy Center	77	27	52.7	1.65	
Dwight	77	30	54.4	2.09		Markle	78	30	55.0	4.10		Guthrie Center	78	28	53.0	2.27	
Efingham	80	29	59.4	2.03		Mauzy	81	27	56.3	4.06		Hampton	79	29	53.3	1.33	
Equality	87	26	61.0	1.06		Mounts Hill	82	30	58.2	2.06		Harlan	79	24	52.5	2.25	
Fandon	79	30	56.4	2.42		Mount Vernon	81	33	60.8	2.87		Hopeville				4.62	
Flora	81	30	62.2	1.01		Northfield	76	26	54.6	1.83		Humboldt	77	28	52.2	1.14	
Friendgrove	79	29	58.8	1.57		Paoli	82	28	58.8	3.27		Idagrove	83	26	52.2	1.47	
Galva	80	29	55.4	3.28		Prairie Creek	87	27	59.0	1.56		Independence	76	25	51.8	1.65	
Grafton				1.91		Princeton	79	27	58.4	2.80		Indianola	78	30	55.4	3.25	
Greenville	84	31	56.8	3.24		Rensselaer	75	31	54.8	1.52		Iowa City	80	28	55.2	3.12	
Griggsville	81	32	59.5	2.58		Richmond	81	27	55.4	3.01		Iowa Falls	76	26	50.7	1.60	
Halfway	83	30	61.4	0.78		Rockville	79	33	57.4	2.04		Jefferson	80	26	53.6	3.62	
Halliday	82	23	60.3	1.51		Salem	85	27	59.8	2.70		Keosauqua	80	29	56.0	3.70	
Henry	80	29	56.0	1.60		Scottsburg	82	32	58.2	3.04		Lacona				4.66	
Hillsboro	81	30	59.0	2.52		Seymour	80	32	57.0	2.95		Lansing	76	27	52.8	1.76	
Hoopeston	78	32	54.6	1.99		Shelbyville				3.41		Larrabee	77	21	50.9	0.80	
Joliet	78	32	53.9	2.44		South Bend	78	34	55.0	1.46		Leclaire				3.71	
Kishwaukee	79	27	52.6	2.07		Syracuse	81	30	53.9	1.61		Lemars	78	24	51.6	0.44	
Knoxville	78	28	54.6	3.27		Terre Haute	80	35	59.2	2.51		Lenox	77	27	54.6	3.11	
Lagrange	76	30	53.0	2.09		Topeka	74	30	52.2	1.41		Leon	77	29	56.0	3.77	
Laharpe	80	28	56.2	2.65		Valparaiso	77	33	54.0	1.56		Logan	78	26	54.2	3.26	
Lanark	76	24	51.2	3.08		Vevay	82	34	59.2	2.80		Maple Valley				1.19	
Lasalle	82	31	57.4	1.67		Vincennes	82	29	60.0	2.15		Maquoketa	78	27	53.3	2.37	
Loami				2.49		Washington	81	29	59.0	4.16		Marshalltown	79	29	53.7	1.81	
McLeansboro	83	27	61.0	0.85		Winamac	77	26	52.2	2.60		Monticello	78	27	54.4	1.39	
Martinsville	82	26	58.2	1.39		Worthington	81	28	58.8	2.34		Mountair	77	27	55.4	3.30	
Martinton	79	31	55.8	1.72		Indian Territory.						Mount Pleasant	75	26	53.8	4.65	
Mascoutah	78	28	57.3	1.55		Ardmore	83	41	63.6	4.06		Mount Vernon	78	27	55.1	3.86	
Mattoon	78	32	60.2	1.53		Chickasha	86	34	63.1	2.14		New Hampton	73	26	50.0	1.40	
Minonk	78	29	54.7	1.59		Durant	85	41	63.6	2.00		Newton	75	27	53.3	6.66	
Monmouth	78	27	54.2	3.39		Fairland	84	33	62.2	2.49		Northwood	73	30	50.2	3.11	
Monticello	81	32	57.1	1.35		Fort Apache	83	30	56.2	0.30		Odebolt	76	25	52.6	1.06	
Morrison	80	30	54.4	2.78		Goodwater	86	37	62.9	2.85		Ogden	80	26	55.9	2.69	
Morrisonville	80	30	58.3	2.45		Hartshorne	85	38	64.6	1.38		Olin	82	27	52.4	2.88	
Mount Carmel				1.83		Heldton	89	38	63.8	3.22		Onawa	82	26	55.8	1.56	
Mount Pulaski	81	31	58.4	2.24		Holbrook	85	39	63.0	1.38		Osage	72	29	49.6	1.46	
Mount Vernon	82	28	61.7	0.28		Marlow	88	38	64.0	3.16		Osceola	78	29	55.2	3.82	
Olney	81	28	60.2	1.33		Muskogee	83	39	62.8	2.68		Oskaloosa	79	30	55.0	3.60	
Ottawa	80	33	56.8	1.87		Pauls Valley	77	38	56.0	3.20		Ottumwa	78	33	57.2	4.80	
Palestine	82	28	57.8	2.40		South McAlester				3.56		Ovid	79	28	56.3	4.60	
Pana	79	30	57.9	2.32		Tablequah	86	35	62.0	2.71		Pacific Junction	79	25	55.1	2.78	
Paris	79	33	59.3	2.11		Tulsa				2.30		Perry	78	28	53.4	3.94	
Peoria a				2.79		Wagoner	90	39	67.8	1.80		Plover	77	20	48.9	1.48	
Peoria b	80	31	57.6	3.78		Webbers Falls				2.30		Pringhar	75	22	52.6	0.30	
Philo	79	29	56.8	3.39		Iowa.						Red Oak	76	31	56.0	2.71	
Plumhill	81	31	59.8	1.17		Afton	78	27	55.0	4.32		Ridgeway	81	28	53.8	1.57	
Rantoul	80	31	56.8	2.85		Albia	81	28	55.6	4.57		Rockford				0.70	
Raum	82	31	61.7	1.70		Algona	79	28	52.9	1.10		Rockwell City	76	29	53.1	1.45	
Riley	75	29	52.9	2.90		Allerton	79	29	56.2	3.52		Sac City	77	28	53.5	1.16	
Robinson	80	26	58.8	1.65		Alta	74	26	51.5	1.11		St. Charles	79	31	56.6	5.77	
Rushville	79	30	57.7	2.86		Amama	76	28	53.7	3.71		Seranton	76	28	52.6	1.79	
St. Charles	80	29	53.2	2.19		Ames	77	26	52.8	2.56		Sheldon	77	24	51.8	0.70	
St. John	81	27	60.6	1.02		Atlantic	80	23	53.6	2.51		Sibley	79	22	51.6	0.68	
Shobonier	85	27	60.1	1.52		Audubon	79	26	54.2	1.79		Sigourney	82	26	54.4	4.79	
Streator	79	31	55.0	3.24		Baxter	79	25	54.0	4.33		Sioux Center	75	25	51.4	0.28	
Sullivan	82	29	58.2	2.24		Bedford	79	24	55.8	2.95		Spirit Lake	83	24	51.3	0.48	
Sycamore	77	30	53.8	3.10		Belknap	78	28	55.1	4.35		Stockport				4.35	
Tilden	80	31	59.5	1.42		Bonaparte	79										

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		
Stations.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.							Kentucky—Cont'd.							Maryland—Cont'd.										
Colby	87	26	54.6	1.69			Mayfield	81	32	61.4	3.28		Deep Park	72	17	50.4	4.52		Derby	72	17	50.4	4.52	
Columbus	80	33	59.8	1.75			Maysville	89	31	59.3	2.34		Denton	80	28	59.6	5.98		Denton	80	28	59.6	5.98	
Cunningham	87	28	59.6	1.58			Middlesboro	79	30	58.4	2.53		Easton	77	30	59.1	6.71		Easton	77	30	59.1	6.71	
Delphos	85	25	57.6	3.40			Mount Sterling	80	33	58.0	2.08		Fallston	79	30	57.0	8.06		Fallston	79	30	57.0	8.06	
Dresden	86	28	55.8	1.79			Owensboro	82	30	61.4	3.06		Frederick	83	25	58.6	4.87		Frederick	83	25	58.6	4.87	
Ellinwood	85	29	59.5	1.60			Owenton	78	34	57.4	1.90		Grantsville	74	23	51.8	4.00	0.6	Grantsville	74	23	51.8	4.00	0.6
Emporia	81	35	59.3	2.23			Paducah a				2.91		Greatfalls	81	26	58.8	7.82		Greatfalls	81	26	58.8	7.82	
Englewood	90	29	60.9	2.68			Paducah b	85	34	63.4	2.67		Greenspring Furnace	78	24	54.4	3.68		Greenspring Furnace	78	24	54.4	3.68	
Eureka				1.93			Pikeville	87	30	62.9	1.98		Hancock	82	23	55.8	3.42		Hancock	82	23	55.8	3.42	
Eureka Ranch		23		2.31			Princeton				3.63		Harney				5.77		Harney				5.77	
Fallriver	84	31	60.8	1.91			Richmond	82	33	60.7	2.70		Jewell	79	31	59.4	7.12		Jewell	79	31	59.4	7.12	
Farnsworth	87	23	56.2	2.28			St. John	82	29	59.0	1.36		Johns Hopkins Hospital	80	32	58.0	7.38		Johns Hopkins Hospital	80	32	58.0	7.38	
Forsha	89	27	61.0	1.76			Scott	83	32	58.8	1.78		Laurel	82	26	56.4	5.83		Laurel	82	26	56.4	5.83	
Fort Leavenworth	81	34	61.0	2.69			Shelby City	85	28	59.5	2.41		McDonogh	80	28	57.2	7.22		McDonogh	80	28	57.2	7.22	
Fort Scott	84	32	60.4	0.95			Shelbyville	90	29	60.2	2.32		Mount St. Marys College	77	32	55.4	7.42		Mount St. Marys College	77	32	55.4	7.42	
Frankfort	84	26	58.5	3.72			Taylorsville	80	28	57.1	1.40		Newmarket	77	29	56.8	6.52		Newmarket	77	29	56.8	6.52	
Fredonia	88	38	61.8	1.09			Warfield		28		3.03		Pocomoke	78	31	61.4	2.05		Pocomoke	78	31	61.4	2.05	
Garden City	88	27	58.0	2.62			Williamsburg	91	30	62.7	2.32		Princess Anne	82	27	59.3	3.06		Princess Anne	82	27	59.3	3.06	
Gove	90	28	55.8	2.25			Williamstown	83	31	60.2	2.56		Queenstown	80	31	58.2	6.47		Queenstown	80	31	58.2	6.47	
Grenola	85	30	59.0	1.72			Louisiana					Solomons	79	38	62.0	5.04		Solomons	79	38	62.0	5.04		
Hanover	81	26	57.4	4.00			Abbeville	90	42	68.8	3.23		Sudlersville	80	30	59.2	4.97		Sudlersville	80	30	59.2	4.97	
Harrison	85	22	57.0	2.52			Alexandria	93	37	66.7	6.12		Sunnyside	73	21	52.2	4.77		Sunnyside	73	21	52.2	4.77	
Hays	85	25	56.6	2.56			Amite	89	37	66.5	2.78		Takoma Park	78	30	56.9	6.24		Takoma Park	78	30	56.9	6.24	
Holt	82	29	57.7	3.05			Baton Rouge	87	41	66.6	2.81		Van Bibber	76	29	56.4	7.29		Van Bibber	76	29	56.4	7.29	
Horton	81	30	58.8	3.34			Burnside	88	41	67.3	3.64		Westernport	85	24	56.2	2.41		Westernport	85	24	56.2	2.41	
Hoxie	85	25	55.4				Calhoun	86	31	65.6	3.58		Woodstock	77	30	58.2	6.35		Woodstock	77	30	58.2	6.35	
Hutchinson	94	25	59.4	2.22			Cameron	85	50	69.6	1.94		Massachusetts						Amherst	74	22	50.3	5.59	
Independence	84	33	61.9	0.82			Cheneyville	88	38	65.5	2.30		Bedford	73	26	50.9	5.05		Bedford	73	26	50.9	5.05	
Jetmore	90	28	59.8	2.10			Clinton	87	37	65.9	2.01		Bluehill (summit)	73	28	51.4	4.54		Bluehill (summit)	73	28	51.4	4.54	
Lakin	86	27	56.4	1.93			Collinston	91	35	66.0	4.00		Chestnut Hill	75	26	54.2	4.79		Chestnut Hill	75	26	54.2	4.79	
Lawrence	80	32	59.0	3.28			Covington	91	37	68.5	2.03		Cohasset				4.49		Cohasset				4.49	
Lebanon	80	24	55.2	2.10			Donaldsonville	88	47	68.6	4.62		Concord	77	23	50.4	4.76		Concord	77	23	50.4	4.76	
Lebo	82	31	59.8	2.71			Emile	87	40	67.1	1.44		East Templeton	69	27	48.2	4.65		East Templeton	69	27	48.2	4.65	
Leoti	87	27	56.3	1.70			Farmerville	85	36	61.5	1.75		Fallriver	73	35	53.6	4.11		Fallriver	73	35	53.6	4.11	
Little River	85	25	59.6	1.97			Franklin	92	44	68.6	2.16		Fitchburg a	72	25	49.2	6.30		Fitchburg a	72	25	49.2	6.30	
Macksville	87	28	58.0	1.76			Grand Coteau	85	43	67.6	2.69		Fitchburg b	73	26	50.6	6.28		Fitchburg b	73	26	50.6	6.28	
McPherson	87	27	60.2	3.24			Hammond	86	39	66.5	4.96		Framingham	78	22	50.8	4.20		Framingham	78	22	50.8	4.20	
Madison	85	29	58.6	2.35			Houma	90	43	68.2	1.72		Groton	76	23	49.4	6.38		Groton	76	23	49.4	6.38	
Manhattan	87	27	60.4	2.19			Jennings	89	45	68.2	5.12		Hyannis	70	31	53.8	5.89		Hyannis	70	31	53.8	5.89	
Marion	86	30	59.6	2.25			Lafayette	89	41	68.1	3.09		Jefferson				6.76		Jefferson				6.76	
Meade				2.93			Lake Charles	89	46	69.5	4.82		Lawrence	75	27	51.4	4.29		Lawrence	75	27	51.4	4.29	
Medicine Lodge	89	30	61.4	1.28			Lake Providence	86	40	65.6	1.00		Leominster				6.54		Leominster				6.54	
Minneapolis	84	27	58.8	2.31			Lakeside	90	50	69.2	1.75		Lowell	74	27	53.3	5.29		Lowell	74	27	53.3	5.29	
Moran	85	30	61.2	1.06			Lawrence	91	52	70.2	3.41		Lowell b	75	25	52.2			Lowell b	75	25	52.2		
Mouthhope	82	26	59.2	1.72			Libertyville	88	37	66.3	3.44		Ludlow Center	69	22	46.4	5.30		Ludlow Center	69	22	46.4	5.30	
Ness City	87	31	58.8	2.02			Mansfield	90	35	64.8	4.32		Middleboro	74	22	51.8	5.02		Middleboro	74	22	51.8	5.02	
Newton	84	34	60.4	2.13			Melville	87	37	65.1	2.20		Monson	72	22	50.6	5.08		Monson	72	22	50.6	5.08	
Norwich	86	29	61.2	1.23			Minden	89	40	65.6	3.36		New Bedford	72	30	53.1	6.19		New Bedford	72	30	53.1	6.19	
Oberlin				2.36			Monroe	89	41	66.6	2.35		Plymouth	70	34	53.1	5.32		Plymouth	70	34	53.1	5.32	
Olathe	80	30	59.2	2.42			New Iberia	86	48	69.4	3.10		Princeton				6.56		Princeton				6.56	
Oswego	85	33	62.0	1.35			Opelousas	87	44	67.0	4.37		Princeton	72	34	54.0	3.88		Princeton	72	34	54.0	3.88	
Ottawa	84	28	58.6	2.47			Oxford	89	37	66.4	3.97		Salem				5.06		Salem				5.06	
Paola	81	32	59.6	2.37			Paincourtville	84	42	66.0	2.26		Somerset	76	28	55.4	3.88		Somerset	76	28	55.4	3.88	
Phillipsburg				2.54			Plain Dealing	87	40	64.8	3.82		Sterling				6.38		Sterling				6.38	
Pratt	88	26	59.0	1.95			Port Eads	90	59	75.7	9.11		Taunton	73	20	51.1	3.68		Taunton	73	20	51.1	3.68	
Republic	86	23	57.0	3.																				

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.		Stations.	Temperature. (Fahrenheit.)			Precipitation.		Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.						Minnesota—Cont'd.						Missouri—Cont'd.					
Fennville	70	32	51.6	2.21		Glencoe	75	20	45.0	1.35		Avalon	84	30	60.5	3.25	
Fitchburg	76	25	50.4	1.99		Grand Meadow	76	17	48.8	1.84		Bethany	78	27	56.4	2.75	
Flint	74	25	49.2	2.66		Hallock	75	13	43.4	1.57		Birchtree	82	32	61.6	2.10	
Frankfort	63	31	48.6	1.43	T.	Lake Winnibigoshish	68	24	44.5	1.20		Boonville					2.10
Gaylord	70	18	43.6	3.20	T.	Leech	73	21	42.8	3.64		Brunswick	82	30	58.9	2.02	
Gladwin	72	20	47.2	1.90	T.	Long Prairie	74	23	45.5	2.17	0.5	Caruthersville	86	30	63.1	2.52	
Grand Marais	69	30	45.3	2.08	T.	Luverne	76	22	49.0	0.61		Conception	78	34	56.2	3.19	
Grand Rapids	71	30	51.2	1.50		Lynd	77	21	48.4	1.01		Darksville	80	36	59.7	2.45	
Grape	78	28	52.2	1.66		Maple Plain	74	26	48.4	1.71	0.5	Dean	86	34	61.0	2.59	
Grayling	72	18	46.2	2.55	0.5	Milaca	73	19	44.8	2.26	T.	Desoto	83	31	61.5	1.96	
Hagar	73	30	53.7	5.92		Milan	79	24	47.2	1.00		Downing					3.40
Hanover	75	26	50.8	2.15		Minneapolis	75	27	47.2	1.51	T.	Edgehill	76	28	55.6	1.52	
Harbor Beach	75	30	50.7	3.00	T.	Montevideo	76	23	47.4	1.05	T.	Edwards	84	27	60.3	2.16	
Harrisville	73	27	47.3	3.44	T.	Morris	74	24	47.0	1.67	0.2	Eightmile		33	54.1	1.30	
Hart	68	27	48.2	2.29		Mount Iron	68	17	42.0	2.40	T.	Eldon	83	26	57.7	2.21	
Hastings	74	26	51.0	2.68		New London	67	24	44.8	1.59		Fairport					2.97
Hayes	72	25	48.2	6.19	T.	New Richland	76	29	50.0	1.51	T.	Fayette	83	32	61.1	2.66	
Highland Station				2.28		New Ulm	74	29	50.0	1.45		Fulton	82	28	59.4	3.19	
Hillsdale	75	26	51.0	1.64		Park Rapids	69	22	43.8	2.36		Gallatin	82	32	59.6	3.33	
Humboldt	67	12	40.2	1.76	T.	Pine River	72	25	44.7	5.35	T.	Glasgow	82	30	59.6	1.66	
Iron Mountain	68	20	44.5	1.48		Pipestone	73	28	49.4	1.45	T.	Gorin					2.67
Iron River	69	16	42.0	3.55	T.	Pleasant Mounds	76	28	50.6	0.94	T.	Grant City	79	29	57.6	2.86	
Ironwood	68	25	44.2	1.94	T.	Pokegama Falls	72	15	40.9	1.97		Halfway	83	32	59.6	2.55	
Ishpeming	67	25	42.2	3.71	1.5	Redwing				2.62		Harrisonville	82	29	58.3	1.64	
Ivan	69	30	45.0	3.05	1.0	Redwing	74	30	52.6	2.70		Hazlehurst					2.62
Jackson	72	28	51.6	1.62		Reeds				2.56		Hermann					2.87
Jeddo	75	29	49.7	2.12	T.	Rolling Green	73	28	49.5	0.51	T.	Houston	81	29	59.6	2.67	
Kalamazoo	70	31	50.8	2.98		St. Cloud	73	21	47.6	1.63	T.	Huntsville	81	31	59.6	2.72	
Lake City	68	18	45.6	0.75		St. Peter	76	27	49.2	2.62		Ironton	84	25	59.1	2.10	
Lansing	74	28	50.0	1.76		Sandy Lake Dam	70	24	43.9	2.31		Jackson	84	26	60.6	0.87	
Lapeer	76	26	50.2	1.78		Shakopee	75	25	48.4	1.34		Jefferson City	85	28	59.4	2.38	
Lincoln	71	23	48.4	3.81	T.	Tower	66	18	42.8	2.70	T.	Joplin	83	36	62.9	2.24	
Ludington	66	40	48.8	0.30		Two Harbors	68	24	42.8	2.57		Kidder	80	29	58.6	2.63	
Mackinac Island	62	28	47.7	2.62	1.5	Wabasha	76	29	51.1	2.26		Lamar	84	32	61.8	1.92	
Mackinaw	66	28	46.0	3.32		Willow River	75	22	44.8	2.82		Lamonte					1.77
Mancelona	68	20	45.0	2.90	T.	Winnebago City	75	28	49.6	1.04	0.2	Lebanon	88	30	60.6	2.59	
Manistee	70	22	49.0	0.55		Winona	71	32	50.7	1.77	T.	Lexington	82	31	60.6	2.43	
Manistiquette	65	23	45.3	2.16	T.	Worthington	72	25	49.9	0.14		Liberty	86	28	59.4	1.63	
Menominee	75	26	47.7	1.60								Louisiana	82	30	58.8	3.06	
Midland	73	25	50.8	3.40	T.	Aberdeen	89	30	62.8	1.56		Macon	82	29	58.8	3.05	
Mio	67	13	44.6	3.62	0.1	Agricultural College	86	37	64.5	2.16		Marble Hill	83	26	60.7	1.14	
Mount Clemens	76	27	52.4	3.10		Austin	83	34	63.2	2.32		Marshall	80	27	59.0	2.45	
Mount Pleasant	72	20	48.2	2.65		Batesville	83	29	61.7	1.67		Maryville	80	30	55.4	3.05	
Muskegon	68	31	50.9	2.57	T.	Bay St. Louis	87	46	68.5	7.65		Mexico	83	29	59.0	2.43	
Newberry	72	20	46.1	1.10		Biloxi	87	44	69.0	3.61		Miami	81	32	60.2	4.43	
North Marshall	74	29	50.8	2.85		Booneville	81	32	62.0	0.63		Monroe City	82	31	58.0	2.45	
Old Mission	70	30	47.8	2.97	T.	Brookhaven	85	33	62.8	1.00		Montreal	84	26	59.6	3.57	
Olivet	72	30	50.2	2.53	T.	Canton	85	30	64.7	1.23		Mountaingrove	81	29	59.2	2.64	
Omer	73	19	46.7	3.41	T.	Columbus	83	34	62.0	2.99		Mount Vernon	86	35	62.5	3.95	
Onaway	68	20	45.0	2.29	T.	Corinth	83	30	60.8	1.00		Neosho	83	34	60.4	2.81	
Ontonagon	69	25	44.2	1.53	T.	Crystalsprings	87	36	64.7	0.82		Nevada					1.35
Ovid	72	25	49.8	2.57		Duck Hill	84	28	62.6	0.57		New Haven	84	32	61.7	3.06	
Owosso				2.20		Edwards	89	35	67.2	1.98		New Madrid					1.65
Potoskey	68	26	45.4	2.92	T.	Fayette	84	35	64.5	0.65		New Palestine	83	31	60.4	2.12	
Plymouth	71	22	48.4	1.81		Fayette (near)				0.53		Oakfield	82	31	60.5	3.22	
Port Austin	74	32	50.3	2.18		Greenville	81	40	64.0	2.48		Olden	81	32	60.9	2.49	
Powers	72	21	45.5			Greenville	87	37	65.3	2.52		Oregon	81	32	58.9	4.72	
Reed City	65	21	43.7	2.81		Greenwood	85	32	62.8	0.69		Palmyra	82	30	58.1	3.31	
Rosecommon	72	15	44.6	0.47	T.	Hattiesburg	90	35	67.4	4.20		Phillipsburg					2.70
Saginaw	73	26	50.2	2.96		Hazlehurst	88	36	64.8	1.06		Pine Hill					1.42
St. Ignace				1.40		Hernando	82	36	62.0	1.63		Potosi (near)	83	23	57.6	1.85	
St. Johns	72	28	50.6	2.46	T.	Holly Springs	81	40	62.4	1.22		Princeton	78	31	57.0	2.89	
St. Joseph	73	33	53.2	3.43		Indianola	88	32	63.4	1.00		Rockport					3.89
Sidnaw	70				T.	Jackson	91	34	65.6	2.95		Rolla					2.46
Somerset	74	25	50.2	1.55		Kosciusko	84	33	63.2	1.23		St. Charles	82	32	60.8	3.48	
South Haven	71	31	52.8	1.87		Lake	84	30	61.8	2.13		St. Joseph					3.29
Stanton	70	24	49.7	4.73		Lake Como	89	31	64.9	1.65		Sarcozie					2.33
Thomaston	60	11	39.8	2.52	T.	Laurel	87	36	66.8	0.04		Sedalia	80	29	60.0	1.33	
Thornville	73	28	49.8	2.77		Leakesville	91	30	66.7	5.75		Seymour	79	30	58.8	3.40	
Vans Harbor	70	23	47.4	1.64	T.	Louisville	88	32	64.6	1.42		Shelbina					2.99
Vassar	74	23	50.6	1.96		Macon	83	33	61.6	0.94		Sticks	82	28	61.0	1.05	
Wasopi	81	30	51.6	1.72	T.	Magnolia	87	33	65.6	1.29		Steffenville	81	30	58.6	2.59	
Waverly	70	30	51.0	4.89	T.	Natchez	88	44	67.4	0.97		Trenton	77	31	57.5	2.97	
Webberville	75	27	50.8	2.24		Nittayuma	84	34	633								

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.			
Stations.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
Montana—Cont'd.							Nebraska—Cont'd.							New Hampshire—Cont'd.											
Glasgow	80	12	45.2	0.23			Madrid	88	25	54.6	0.75		Grafton	72	17	44.0	4.09		Grafton	72	17	44.0	4.09		
Glendive	85	22	47.0	0.30		2.0	Marquette				4.46		Hanover	72	20	46.2	4.23		Hanover	72	20	46.2	4.23		
Greatfalls	77	22	48.8	0.07		0.2	Minden b.	80	23	54.0	2.94		Keene	76	19	48.4	4.14		Keene	76	19	48.4	4.14		
Kipp	75	15	43.5	0.30			Monroe				2.97		Littleton	66	19	44.2	4.64		Littleton	66	19	44.2	4.64		
Lewistown	81	23	48.4	T.			Nebraska City b*1.	82	30	58.0	3.74		Nashua	78	24	51.2	5.96		Nashua	78	24	51.2	5.96		
Manhattan	74	13	44.7	0.01			Nemaha				3.40		Newton	75	22	49.2	5.24		Newton	75	22	49.2	5.24		
Marysville	81	23	47.7	0.18		T.	Nesbit	86	21	52.2	1.36		Peterboro	72	20	48.2	4.88		Peterboro	72	20	48.2	4.88		
Missoula	76	24	48.8	0.25			Norfolk	84	18	54.0	1.06		Plymouth	70	20	46.0	4.27		Plymouth	70	20	46.0	4.27		
Parrot	77	27	47.8	0.35			North Loup	85	18	54.6	2.24		Sanbornton	73	21	46.8	4.13		Sanbornton	73	21	46.8	4.13		
Plains	72	26	48.2	0.15			Oakdale	80	18	52.2	0.76		Stratford	70	16	44.2	4.06		Stratford	70	16	44.2	4.06		
Poplar	81	19	45.5	0.79			Odell				3.50		New Jersey.												
St. Pauls	81	28	49.0	0.30		T.	O'Neill	84	21	55.0	0.61		Asbury Park	76	29	57.9	6.69		Asbury Park	76	29	57.9	6.69		
St. Peter	74	21	45.8	0.38		0.5	Ord				1.45		Barneget	80	25	57.9	7.93		Barneget	80	25	57.9	7.93		
Springbrook	81	21	47.3	0.80		5.5	Osceola				3.60		Bayonne	79	32	57.2	6.77		Bayonne	79	32	57.2	6.77		
Toston	76	18	46.0	0.14			Palmer				3.90		Belvidere	76	26	55.0	5.62		Belvidere	76	26	55.0	5.62		
Townsend	78	19	45.6	0.25			Palmyra*1.	86	26	55.2	2.57		Bergen Point	77	30	56.1	7.37		Bergen Point	77	30	56.1	7.37		
Troy	75	26	47.0	0.63			Pawnee City				4.16		Beverly	78	26	56.9	7.55		Beverly	78	26	56.9	7.55		
Twin Bridges	73	18	43.0	0.30			Plattsmouth b.	82	25	57.2	1.75		Blairstown	74	24	52.6	5.13		Blairstown	74	24	52.6	5.13		
Twodot	76	20	44.6	0.50			Purdum	88	22	53.2	1.95		Bridgeton	80	29	58.6	4.61		Bridgeton	80	29	58.6	4.61		
Utica	81	23	47.9	0.18			Ravenna a.	80	20	54.0	3.95		Camden	77	35	57.8	7.07		Camden	77	35	57.8	7.07		
Yale	78	16	45.5	0.09			Ravenna b.				3.40		Canton				5.66		Canton				5.66		
Nebraska.							Redcloud	82	24	56.4	2.91		Cape May C. H.	77	27	59.0	5.37		Cape May C. H.	77	27	59.0	5.37		
Agate				0.68			Republican*1.	82	26	57.4	2.24		Charlotteburg	72	26	53.5	6.06		Charlotteburg	72	26	53.5	6.06		
Agate*1.	82	20	50.8	0.99			Rulo				4.54		Chester	73	23	52.3	6.90		Chester	73	23	52.3	6.90		
Albion	82	19	54.5	2.10			St. Libory				3.77		Clayton	78	26	56.8	5.63		Clayton	78	26	56.8	5.63		
Alma	83	20	55.5	2.47			St. Paul	83	21	54.6	3.26		College Farm	76	27	55.9	7.76		College Farm	76	27	55.9	7.76		
Ames	82	26	55.9	2.41			Salem*1.	82	34	61.1	3.78		Culvers Lake				5.60		Culvers Lake				5.60		
Ansley	80	16	50.3	2.24			Santee	82	22	54.2	0.48		Dover	74	24	51.7	6.08		Dover	74	24	51.7	6.08		
Arberville*1.	82	22	51.8	4.00			Schuyler				2.95		Egg Harbor City	76	25	57.0	6.36		Egg Harbor City	76	25	57.0	6.36		
Arcadia	80	24	54.4	0.35			Seward	94	24	55.2	3.60		Elizabeth	75	29	56.5	7.15		Elizabeth	75	29	56.5	7.15		
Ashland a.	84	26	57.4	2.67			Smithfield				2.80		Englewood	74	32	56.0	6.73		Englewood	74	32	56.0	6.73		
Ashland b*1.				2.40			Spragg				1.27		Flemington	76	26	55.7	6.46		Flemington	76	26	55.7	6.46		
Ashton				3.53			Springview	79	23	50.8	0.52		Freehold	75	28	55.2	5.29		Freehold	75	28	55.2	5.29		
Auburn	83	26	57.8	4.75			Stanton	82	19	55.0	1.08		Friesburg	78	27	56.8	6.28		Friesburg	78	27	56.8	6.28		
Aurora	78	27	54.7	4.96			Strang*1.	82	28	55.8	2.55		Hanover	74	25	53.2	6.60		Hanover	74	25	53.2	6.60		
Bartley				1.68			Stratton				1.60		Hightstown	74	28	55.7	9.35		Hightstown	74	28	55.7	9.35		
Beatrice	87	24	57.0	2.59			Superior	82	24	54.2	3.52		Inlaystown	75	30	56.8	6.74		Inlaystown	75	30	56.8	6.74		
Beaver	85	25	55.0	2.06			Syracuse				2.92		Indian Mills	80	23	56.9	5.61		Indian Mills	80	23	56.9	5.61		
Bellevue				2.78			Tablerock				2.09		Lakewood	75	28	56.8	5.92		Lakewood	75	28	56.8	5.92		
Benedict				4.01			Tecumseh b.	83	28	58.0	4.40		Lambertville	75	27	56.3	6.12		Lambertville	75	27	56.3	6.12		
Blair	81	26	53.0	2.17			Tekamah	84	27	56.0	1.42		Layton	73	20	51.6	4.68		Layton	73	20	51.6	4.68		
Bluehill*1.	78	33	57.2	3.05			Turlington	82	27	56.7	3.58		Moorestown	76	27	56.7	7.59		Moorestown	76	27	56.7	7.59		
Bradshaw				5.15			University Farm	85	22	57.0	2.84		Mount Pleasant				5.90		Mount Pleasant				5.90		
Bridgeport	85	24	50.6	1.04			Wakefield	82	19	53.0	0.72		Newark	76	29	55.2	7.06		Newark	76	29	55.2	7.06		
Brokenbow	86	18	51.8	1.41			Wallace				1.25		New Brunswick	77	28	56.4	7.80		New Brunswick	77	28	56.4	7.80		
Burchard				3.51			Weeping Water	79	21	53.0	2.81		New Egypt				5.38		New Egypt				5.38		
Burwell				0.81			Westpoint	84	23	55.4	2.13		Newton	74	25	52.8	5.54		Newton	74	25	52.8	5.54		
Callaway	83	20	52.1	0.95			Wilber*1.	82	32	54.5	3.68		Oceanic	72	31	56.9	6.50		Oceanic	72	31	56.9	6.50		
Cedar Rapids	76	18	51.1	2.58			Wilsonville				2.56		Paterson	76	31	56.8	5.64		Paterson	76	31	56.8	5.64		
Central City				3.52			Winnebago				0.97		Pemberton	75	25	56.0	5.89		Pemberton	75	25	56.0	5.89		
Chester				2.98			Wisner				1.28		Perth Amboy	75	30	56.1	7.75		Perth Amboy	75	30	56.1	7.75		
Cody				0.58			Wymore				2.99		Piscataway				7.22		Piscataway				7.22		
Columbus	79	22	53.8	3.28			York	81	32	56.7	3.53		Plainfield	76	24	54.2	7.24		Plainfield	76	24	54.2	7.24		
Crete	83	25	56.8	3.84			Nevada.							Rancocas				7.10		Rancocas				7.10	
Culbertson				2.07			Amos	76	14	45.6	0.00		Ringwood	75	21	53.7	5.15		Ringwood	75	21	53.7	5.15		
Curtis	82	23	53.3	2.45			Battle Mountain	90	15	53.0	0.10		Rivervale	74	22	53.4	3.96		Rivervale	74	22	53.4	3.96		
Dannebrog				2.43			Beowawe*1.	82	20	53.1	0.40		Roseland	75	24	54.2	6.08		Roseland	75	24	54.2	6.08		
Dawson	84	27	57.8																						

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.																																											
Maximum.		Minimum.		Mean.	Rain and melted snow.	Total depth of snow.		Maximum.		Minimum.		Mean.	Rain and melted snow.	Total depth of snow.		Maximum.		Minimum.		Mean.	Rain and melted snow.	Total depth of snow.																																											
Stations.								Stations.									Stations.																																																
New York.																						New York—Cont'd.																						North Dakota—Cont'd.																					
Adams	74	25	50.6	4.60	T.		Wells	72	19	46.3	6.41	T.				Oakdale	76	26	47.8	0.62																																													
Addison	65	15	40.9	6.60	5.9		West Berne	79	20	49.2	3.66	T.				Pembina	80	15	41.7	1.33																																													
Adirondack Lodge							West Chazy	71	23	45.7						Power	78	23	44.4	4.81																																													
Akron							Westfield	67	29	51.7	3.10					Steele	75	18	42.8	1.56																																													
Alden	69	28	50.9	3.73	T.		Windham	72	20	48.6	3.25	T.				University	73	20	42.8	1.98																																													
Amsterdam							Wolcott	72	24	49.6	2.96	T.				Valley City	77	22	45.0	0.80																																													
Angelica	75	20	51.0	2.06	0.2		Youngstown				1.52	1.5			Willow City	76	14	40.0	0.50																																														
Appleton	72	27	51.0	2.08	T.		North Carolina.										Woodbridge	80	10	40.5	1.25																																												
Arcade	76	20	47.0	4.39	1.0		Brevard	78	26	54.4	4.70					Ohio.																																																	
Athens	72	30	51.6	3.74	T.		Bryson City				1.71					Akron	75	31	53.0	1.33																																													
Atlanta	72	23	48.1	3.25	T.		Chapel Hill	84	34	62.8	3.83					Atwater	70	28	51.3	2.09																																													
Auburn	74	28	49.8	3.71	T.		Cranberry	70	30	53.3	2.89					Bangorville	78	23	52.5	2.40																																													
Avon	74	23	50.6	2.36	T.		Currituck				2.38				Bellefontaine	78	31	53.3	1.85																																														
Axton	70	14	41.4	7.26	T.		Edenton	85	35	62.7	4.27				Benton Ridge	78	29	54.4	2.13																																														
Baldwinsville	74	29	50.2	2.78	T.		Fayetteville	86	34	64.8	2.00				Bethany	80	32	58.6	2.66																																														
Bedford	71	26	53.6	6.19	T.		Flatrock	78	26	56.2	4.28				Binola				2.11																																														
Blue Mountain Lake							Goldsboro	83	35	62.8	4.48				Bladensburg	78	25	52.5	1.44																																														
Bolivar	73	17	49.4	2.68			Graham				4.25				Blaine				2.75																																														
Bouckville	70	24	47.2	3.59	2.0		Greensboro	82	36	60.6	5.61				Bloomington				1.51																																														
Brockport	74	25	50.0	2.13			Henderson	80	36	61.0	1.65				Bowling Green	76	29	53.2	2.94																																														
Caldwell	69	24	48.3	4.88	T.		Hendersonville	81	27	58.1	4.26				Bucyrus	80	28	53.8	1.87																																														
Canaan Four Corners	68	24	48.2	4.57	T.		Henrietta	84	33	61.2	3.34				Cambridge	79	26	55.6	2.75																																														
Cansjoharie	75	22	49.2	3.90	T.		Highlands	79	23	52.7	1.65				Camp Dennison	83	30	56.8	3.16																																														
Carmel	73	25	52.2	6.32	T.		Horse Cove	73	28	56.9	4.15				Canal Dover	76	25	52.5	1.53																																														
Carvers Falls	73	22	45.2	4.84	T.		Hot Springs	79	33	59.4					Canton	75	30	52.6	1.56																																														
Cedarhill	72	27	51.8	2.62	T.		Kinston	84	31	62.9	5.13				Cardington	76	26	53.0	1.60																																														
Cooperstown	70	24	47.0	4.00	T.		Kittyhawk	78	47	66.8	4.96				Cedarville				2.29																																														
Cortland	71	25	49.8	3.59	T.		Lenoir	84	31	58.3	4.82				Centerburg				2.12																																														
Cutchogue	75	32	55.6	3.56	T.		Lexington	79	34	60.0	5.23				Circleville	82	33	57.2	1.96																																														
Dekalb Junction							Linville	69	21	48.7	3.90				Clarksville	80	30	57.5	2.69																																														
Easton							Littleton	82	32	61.1	2.12				Cleveland a	75	35	54.0	3.42																																														
Elba	65	29	47.6	2.67	T.		Louisburg	88	31	62.4	3.00				Cleveland b	76	32	53.1	2.44																																														
Elmira	75	26	51.5	3.30			Lumberton	85	36	63.6	4.44				Clifton	79	31	56.4	2.48																																														
Fayetteville	72	27	49.8	4.08			Marion	82	31	60.0	3.38				Coalton	88	27	57.4	2.55																																														
Franklinville	78	22	50.5	3.59	0.5		Marshall	76	28	55.8	1.67				Colebrook	75	27	52.4	1.50																																														
Gansevoort							Mocksville	85	31	59.8	3.23				Coolville				1.72																																														
Glens Falls	71	24	49.4	4.44	T.		Moncure	88	29	61.6	2.45				Coshocton				1.51																																														
Gloversville	70	22	47.0	4.22			Monroe	85	29	60.6	5.54				Dayton a				3.99																																														
Greenwich	71	22	48.8	3.90	T.		Morganton	81	30	59.3	5.86				Dayton b	80	31	56.4	3.25																																														
Griffin Corners	71	17	47.6	4.84	T.		Mountain	80	29	58.0	3.63				Defiance	78	27	53.4	5.24																																														
Harkness	71	20	46.5	2.95	T.		Murphy				1.89			Delaware	80	29	53.9	2.41																																															
Haskinville							Newbern	85	37	65.2	3.99			Demos	74	30	55.0	1.80																																															
Hemlock	67	29	50.0	2.68			Patterson	76	28	54.6	3.78			Dunham				1.47																																															
Honey Brook	70	24	50.8	4.12			Penelo	85	31	63.4	3.70			Dunkirk				1.71																																															
Humphrey	67	27	49.4	3.50	0.8		Pittsboro	88	30	62.8	2.22			Elyria	77	31	53.6	3.42																																															
Indian Lake	69	12	43.4	5.42	T.		Red Springs	90	33	66.2	4.85			Findlay	81	28	55.8	1.78																																															
Ithaca	73	27	49.2	3.36	T.		Reidsville	85	32	61.4	4.43			Fort Recovery				2.78																																															
Jamestown	75	23	51.4	2.91	T.		Rockingham	83	34	62.9	2.22			Frankfort	79	31	55.6	2.04																																															
Keene Valley	70	18	44.8	5.75	0.2		Roxboro	86	33	62.4	4.63			Fremon	80	30	54.6	2.22																																															
King Ferry							Salem	80	31	59.0	5.05			Galagher				3.01																																															
Liberty	79	20	48.4	3.73	T.		Salisbury	85	34	62.1	4.99			Garrettsville	76	24	52.1	1.88																																															
Little Falls, City Res.	72	26	48.3	4.40			Saxon	88	28	59.6	5.56			Granville	79	29	55.1	3.06																																															
Lockport	71	29	50.7	2.60	T.		Selma	85	32	62.8	2.75			Gratiot	79	28	53.7	2.65																																															
Lowville	69	20	45.4	4.15			Settle	81	34	60.4	3.84			Green	81	31	57.5	1.85																																															
Lyons	74	29	51.0	2.79	T.		Sloan	87	34	65.0	6.04			Greenfield	78	34	56.6	2.42																																															
Middletown	71	29	52.6	4.48	T.		Soapstone Mount	82	28	59.4	4.23			Greenhill	77	23	51.8	1.20																																															
Mohawk Lake	68	30	50.1	5.90	T.		Southern Pines a	86	35	65.6	2.92			Greenville	77	31	55.9	3.29																																															
Moir	70	21	45.4	2.44	T.		Southern Pines b	83	35	64.6	2.82			Hanging Rock	83	29	59.2	1.62																																															
Mount Erie	68	26	49.4	3.69	T.		Southport	85	42	69.4	1.93			Hedges	77	28	53.8	3.45																																															
Newark Valley							Springhope	85	36	62.8	2.15			Hillhouse	75	25	51.0	5.21																																															
New Lisbon	71	17	45.6	4.11	1.0		Statesville	83	29	60.0	3.86			Hiram	75	29	53.0	2.06																																															
North Hammond	66	24	47.6	2.11	0.1		Tarboro	88	32	65.2	3.17			Hudson	74	21	51.5	2.23																																															
Number Four	66	14	43.8	5.26	1.5		Washington	86	37	66.0	4.24			Jacksonboro	82	30	55.2	4.19																																															
Ogdensburg	66	23	43.8	2.40	T.		Waynesville	83	28	57.8	1.34			Killbuck	77	29	54.0	1.29																																															
Old Chatham							Weldon a	79	35	61.6	3.19			Lancaster	80	31	55.6	1.90																																															
Oncota	74	22	49.4	4.91	T.		Weldon b				3.09			Lima																																																			

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		Temperature. (Fahrenheit.)						Precipitation.		
Stations.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.							Oregon—Cont'd.							Pennsylvania—Cont'd.										
Richfield	80	29	55.0	1.52	2.56	Lakeview	79	17	43.0	1.17	Somerset	76	24	51.8	4.25	Ins.	South Bethlehem	74	29	54.1	5.90	Ins.		
Richwood	80	30	57.6	1.99	2.56	Lone Rock	79	29	52.2	0.49	South Eaton	74	25	52.2	7.05	Ins.	Spring Mount	71	28	51.6	6.26	Ins.		
Ripley	76	30	53.0	1.06	2.56	McKenzie Bridge	91	30	53.6	2.70	State College	71	28	51.6	4.25	Ins.	Sunbury	72	30	55.2	4.70	Ins.		
Rittman	79	28	54.2	2.62	2.56	McMinnville	84	36	54.6	2.59	Swathmore	72	30	55.2	7.42	Ins.	Towanda	74	23	51.2	3.35	Ins.		
Rockyridge	80	29	53.0	1.37	2.56	Merlin	85	32	52.6	0.84	Trountrun	75	32	57.2	3.65	Ins.	Uniontown	75	32	57.2	3.65	Ins.		
Shenandoah	80	32	56.4	2.87	2.56	Monmouth b*1	80	40	54.3	1.15	Warren	73	24	53.0	2.89	Ins.	Wellshoro	75	24	50.4	2.14	Ins.		
Sidney	79	32	56.4	2.87	2.56	Monroe	83	34	54.3	2.08	Westchester	76	31	56.4	7.92	Ins.	West Newton	75	26	51.9	4.29	Ins.		
Somerset	80	30	57.6	2.34	2.56	Mount Angel	81	36	54.2	2.81	Williamsport	70	26	54.0	2.10	Ins.	York	79	27	55.5	6.40	Ins.		
Springfield	80	30	57.6	2.34	2.56	Nehalem	86	35	54.3	2.15	Rhode Island.						Bristol	72	33	54.6	4.06	Ins.		
Strongsville	82	31	57.6	1.67	2.56	Newberg	81	41	55.2	2.92	Kingston	75	24	52.0	4.26	Ins.	Kingston	75	24	52.0	4.26	Ins.		
Swanton	80	31	54.5	1.84	2.56	Newport	92	17	52.4	0.51	Narragansett	76	26	53.8	4.54	Ins.	Narragansett	76	26	53.8	4.54	Ins.		
Thurman	79	29	55.4	1.81	2.56	Pine	89	22	52.4	0.36	Pawtucket	78	30	54.0	4.29	Ins.	Pawtucket	78	30	54.0	4.29	Ins.		
Upper Sandusky	76	29	52.9	2.66	2.56	Placer	95	39	55.1	0.39	Providence a	74	33	54.4	4.57	Ins.	Providence a	74	33	54.4	4.57	Ins.		
Urbana	80	30	54.3	2.03	2.56	Prineville	84	11	49.8	0.21	Providence c	74	30	52.9	4.83	Ins.	Providence c	74	30	52.9	4.83	Ins.		
Vickery	80	30	54.3	2.03	2.56	Rattles *1	86	23	53.6	1.07	South Carolina.						Aiken	98	35	69.6	4.42	Ins.		
Wadsworth	80	30	54.3	2.03	2.56	Riverside	86	23	53.6	1.07	Alendale	88	40	66.7	5.33	Ins.	Allendale	88	40	66.7	5.33	Ins.		
Walnut	77	27	52.8	1.79	2.56	Sheridan *1	70	45	55.1	1.90	Anderson	86	36	63.6	2.24	Ins.	Anderson	86	36	63.6	2.24	Ins.		
Warren	77	27	52.8	1.79	2.56	Silverton	82	46	57.5	1.52	Barksdale	86	36	63.6	3.10	Ins.	Barksdale	86	36	63.6	3.10	Ins.		
Warsaw	78	23	52.4	1.55	2.56	Siskiyou *1	80	36	54.0	1.32	Batesburg	89	39	62.5	7.34	Ins.	Batesburg	89	39	62.5	7.34	Ins.		
Wauseon	80	27	53.6	2.07	2.56	Sparta	75	24	50.5	0.52	Beaufort	87	44	69.7	7.32	Ins.	Beaufort	87	44	69.7	7.32	Ins.		
Waverly	83	29	57.8	2.12	2.56	Springfield	68	38	49.8	1.26	Bennettsville	86	34	65.6	2.73	Ins.	Bennettsville	86	34	65.6	2.73	Ins.		
Waynesville	78	30	55.7	1.69	2.56	The Dalles	79	35	54.8	0.78	Blackville	87	38	66.2	4.88	Ins.	Blackville	87	38	66.2	4.88	Ins.		
Wellington	77	30	53.8	1.69	2.56	Toledo	90	37	56.7	3.06	Bowman	86	35	65.8	4.80	Ins.	Bowman	86	35	65.8	4.80	Ins.		
Williamstown	77	30	53.8	1.69	2.56	Umatilla	84	39	56.4	0.21	Calhoun Falls	86	35	65.8	3.38	Ins.	Calhoun Falls	86	35	65.8	3.38	Ins.		
Willoughby	77	27	54.0	1.52	2.56	Vale	81	19	48.6	0.54	Camden	86	36	63.6	4.31	Ins.	Camden	86	36	63.6	4.31	Ins.		
Wooster	77	27	54.0	1.52	2.56	Wamie	78	26	51.8	0.80	Cheraw a	86	36	63.6	3.53	Ins.	Cheraw a	86	36	63.6	3.53	Ins.		
Zanesville	77	27	54.0	1.52	2.56	Warm Spring	83	26	52.4	0.30	Cheraw b	86	36	63.6	3.52	Ins.	Cheraw b	86	36	63.6	3.52	Ins.		
Oklahoma.							Westfork *1	76	28	51.3	1.22	Clemson College	85	30	60.8	3.14	Ins.	Clemson College	85	30	60.8	3.14	Ins.	
Ames	88	29	62.8	0.88	2.56	Williams	84	29	52.6	0.60	Conway	87	35	66.2	5.94	Ins.	Conway	87	35	66.2	5.94	Ins.		
Beaver	90	29	59.4	0.84	2.56	Pennsylvania.							Darlington	90	34	65.2	2.96	Ins.	Darlington	90	34	65.2	2.96	Ins.
Blackburn	89	34	60.6	2.50	2.56	Aleppo	77	27	55.9	2.95	Duewest	82	36	64.2	5.25	Ins.	Duewest	82	36	64.2	5.25	Ins.		
Barnett	86	34	62.6	1.50	2.56	Altoona	78	22	53.0	4.36	Edisto	87	38	65.2	5.97	Ins.	Edisto	87	38	65.2	5.97	Ins.		
Chandler	86	39	62.6	1.64	2.56	Athens	79	24	51.2	3.08	Effingham	87	38	65.2	5.97	Ins.	Effingham	87	38	65.2	5.97	Ins.		
Cleo	91	28	62.9	1.19	2.56	Beaver Dam	76	27	54.5	3.49	Florence	87	38	65.2	5.97	Ins.	Florence	87	38	65.2	5.97	Ins.		
Clifton	87	32	62.9	1.14	2.56	Belleville	76	27	54.5	3.49	Gaffney	86	35	62.7	5.28	Ins.	Gaffney	86	35	62.7	5.28	Ins.		
Cloud Chief	87	34	62.9	1.36	2.56	Brookville	76	27	54.5	3.49	Georgetown	87	43	68.0	3.95	Ins.	Georgetown	87	43	68.0	3.95	Ins.		
Enid	87	36	62.1	1.00	2.56	Browsers	80	26	57.4	4.21	Gillisonville	84	37	66.3	5.23	Ins.	Gillisonville	84	37	66.3	5.23	Ins.		
Fort Reno	86	33	61.0	0.80	2.56	California	80	26	57.4	4.21	Greenville	79	34	59.0	3.39	Ins.	Greenville	79	34	59.0	3.39	Ins.		
Fort Sill	84	36	63.6	3.00	2.56	Cassandra	70	24	50.4	5.73	Greenwood	87	33	62.4	4.58	Ins.	Greenwood	87	33	62.4	4.58	Ins.		
Guthrie	87	38	64.3	1.15	2.56	Centerhall	76	23	51.2	5.20	Heath Springs	95	32	62.8	5.32	Ins.	Heath Springs	95	32	62.8	5.32	Ins.		
Hennessey	86	34	64.1	1.10	2.56	Clarion	80	27	55.8	6.78	Kingstree a	83	38	64.3	3.02	Ins.	Kingstree a	83	38	64.3	3.02	Ins.		
Jefferson	92	32	63.2	1.04	2.56	Coatesville	80	27	55.8	6.78	Kingstree b	86	33	61.2	3.43	Ins.	Kingstree b	86	33	61.2	3.43	Ins.		
Jenkins	89	33	62.4	1.33	2.56	Confidence	80	27	55.8	6.78	Liberty	86	33	61.2	3.43	Ins.	Liberty	86	33	61.2	3.43	Ins.		
Kingfisher	87	35	64.4	1.35	2.56	Davis Island Dam	78	26	55.8	5.17	Little Mountain	86	38	64.6	5.93	Ins.	Little Mountain	86	38	64.6	5.93	Ins.		
Mangum	85	42	64.4	2.15	2.56	Derry Station	78	26	55.8	5.17	Longshore	85	35	63.8	4.59	Ins.	Longshore	85	35	63.8	4.59	Ins.		
Newkirk	85	37	62.7	1.02	2.56	Doylestown	78	26	55.8	5.17	Lugoff	86	36	65.1	4.93	Ins.	Lugoff	86	36	65.1	4.93	Ins.		
Norman	85	37	63.2	1.76	2.56	Driftwood	70	20	48.1	3.37	Pinopolis *1	82	45	67.1	4.72	Ins.	Pinopolis *1	82	45	67.1	4.72	Ins.		
Pawhuska	86	36	61.1	1.64	2.56	Dunmore	74	20	48.4	4.77	St. Georges	85	40	66.0	2.69	Ins.	St. Georges	85	40	66.0	2.69	Ins.		
Perry	86	34	62.7	1.14	2.56	Dyberry	74	20	48.4	4.77	St. Matthews	85	40	65.6	5.67	Ins.	St. Matthews	85	40	65.6	5.67	Ins.		
Sac and Fox Agency	85	37	61.9	1.00	2.56	East Bloomsburg	75	23	51.8	5.85	St. Stephens	88	34	63.5	4.56	Ins.	St. Stephens	88	34	63.5	4.56	Ins.		
Shawnee	88	40	63.2	1.30	2.56	East Mauch Chunk	75	23	51.8	5.85	Saluda	86	33	62.4	7.25	Ins.	Saluda	86	33	62.4	7.25	Ins.		
Stillwater	85	36	61.2	0.92	2.56	Easton	72	28	53.8	5.35	Santuck	93	32	64.1	4.04	Ins.	Santuck	93	32	64.1	4.04	Ins.		
Taloga	88	32	62.4	1.07	2.56	Ellwood Junction	72	24	50.9	2.06	Seivern	84	39	64.0	3.50	Ins.	Seivern	84	39	64.0	3.50	Ins.		
Ural	85	33	62.2	1.25	2.56	Emporium	72	24	50.9	2.06	Smiths Mills	84	39	64.0	2.82	Ins.	Smiths Mills	84	39	64.0	2.82	Ins.		
Waukomis	88	35	63.4	1.45	2.56	Ephrata</																		

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.		
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
<i>South Dakota—Cont'd.</i>	°	°	°	Inch.	Inch.	
Gann Valley	84	17	51.2	0.72		
Gary	80	25	49.9	0.70		
Gettysburg	83	12	47.6	0.43		
Grand River School	85	20	53.8	0.38		
Greenwood	83	12	47.6	0.43		
Highmore	84	15	50.2	0.20		
Hotch City	80	22	50.5	2.70		
Howard	81	12	47.3	0.43		
Howell	78	15	46.3	0.52		
Ipawich	79	22	50.8	0.59		
Kimball	85	15	47.8	0.95		
Leola	80	19	51.1	0.65		
Leslie	80	14	47.9	0.54		
Marion	81	16	52.2	0.57		
Mellette	84	24	49.6	1.29		
Menno	82	21	51.8	1.57		
Millbank	82	15	50.0	0.47		
Mitchell	82	21	51.8	1.57		
Oelrichs	82	21	51.8	1.57		
Pedro	82	21	51.8	1.57		
Pine Ridge	82	21	51.8	1.57		
Ramsey	91	19	48.2	1.35		
Redfield	81	14	46.8	0.40		
Rosebud	82	22	51.5	0.76		
Silver City	79	27	50.7	0.85		
Sioux Falls	75	24	43.4	1.80		
Sisseton Agency	78	28	49.9	0.48		
Spearsburg	80	16	52.6	0.57		
Tyndall	82	22	54.1	0.14		
Vermillion	76	21	47.4	1.75		
Watertown	74	20	46.9	2.16		
Waubay	78	25	50.2	1.38		
Wentworth	80	26	52.8	0.35		
Wessington Springs	80	26	52.8	0.87		
Wolsey	80	27	58.1	2.22		
<i>Tennessee.</i>	83	31	60.4	2.64		
Andersonville	87	28	61.2	1.45		
Arlington	86	27	60.6	2.75		
Ashwood	82	30	60.2	1.07		
Benton	79	28	55.6	2.14		
Bluff City	83	35	59.6	1.82		
Bolivar	80	28	59.8	2.78		
Bristol	87	30	60.8	2.80		
Brownsville	80	31	61.2	1.07		
Byrdstown	80	32	61.8	2.52		
Carthage	84	26	60.4	3.01		
Clarksville	79	28	60.5	3.00		
Clinton	79	39	61.4	2.70		
Covington	80	34	58.2	2.03		
Decatur	80	22	55.6	3.89		
Dickson	83	29	60.8	2.00		
Dyersburg	83	31	60.6	3.18		
Elizabethton	78	32	59.4	3.60		
Erasmus	81	28	57.6	1.50		
Florence	81	30	58.7	2.02		
Franklin	82	22	59.2	1.53		
Grace	82	26	59.6	1.86		
Greenville	79	30	55.6	1.25		
Harriman	86	29	62.2	1.00		
Hohenwald	84	28	61.5	1.68		
Iron City	78	43	60.6	1.60		
Isabella	82	32	61.2	3.51		
Jackson	80	32	61.8	2.91		
Johnsonville	84	26	60.4	3.01		
Jonesboro	83	28	61.1	1.90		
Kenton	85	34	61.1	1.87		
Kingston	85	34	61.1	1.87		
Leadvale	85	34	61.1	1.87		
Lebanon	85	34	61.1	1.87		
Lewisburg	85	34	61.1	1.87		
Liberty	85	34	61.1	1.87		
Lynnville	85	34	61.1	1.87		
McKenzie	85	34	61.1	1.87		
McMinnville	85	34	61.1	1.87		
Maryville	85	34	61.1	1.87		
Milan	85	34	61.1	1.87		
Newport	85	34	61.1	1.87		
Nunnally	85	34	61.1	1.87		
Oakhill	85	34	61.1	1.87		
Palmetto	85	34	61.1	1.87		
Pope	85	34	61.1	1.87		
Rogersville	85	34	61.1	1.87		
Rugby	85	34	61.1	1.87		
Savannah	85	34	61.1	1.87		
Sewanee	85	34	61.1	1.87		
Silverlake	85	34	61.1	1.87		
Tazewell	85	34	61.1	1.87		
Tellie Plains	85	34	61.1	1.87		
Tracy City	85	34	61.1	1.87		
Trenton	85	34	61.1	1.87		
Tullahoma	85	34	61.1	1.87		
Union City	85	34	61.1	1.87		
Waynesboro	85	34	61.1	1.87		
Wildersville	85	34	61.1	1.87		
Yukon	85	34	61.1	1.87		
<i>Texas.</i>	82	44	65.2	1.98		
Albany	82	44	65.2	1.98		
Alvin	82	44	65.2	1.98		
<i>Texas—Cont'd.</i>	°	°	°	Inch.	Inch.	
Anna	85	40	64.8	2.82		
Arthur	90	48	68.7	3.63		
Austina	84	46	66.8	0.80		
Austin	90	41	64.4	0.88		
Ballinger	92	47	69.0	0.35		
Bastrop	88	43	68.0	10.24		
Beaumont	96	52	74.1	1.47		
Beeville	91	39	66.0	0.92		
Bigspring	88	44	65.0	1.74		
Boerne	93	49	67.0	2.78		
Booth	85	40	66.0	2.68		
Bowie	89	52	71.1	2.79		
Brazoria	88	49	69.6	11.21		
Brenham	88	54	74.4	1.09		
Brighton	88	47	65.8	0.70		
Brownwood	89	42	66.4	3.28		
Burnet	93	48	72.4	0.30		
Camp Eagle Pass	88	41	65.4	1.40		
Childress	87	47	67.5	1.32		
Coleman	95	48	71.3	4.81		
College	89	35	63.9	0.76		
Colorado	90	47	70.2	5.52		
Columbia	89	39	66.2	2.24		
Comanche	90	44	68.1	3.56		
Corsicana	90	53	71.6	2.97		
Cuero	90	42	65.8	3.71		
Dallas	90	50	73.6	3.21		
Danewang	84	43	64.5	2.35		
Dublin	94	48	71.6	1.33		
Duval	89	42	67.6	1.90		
Earles Ranch	93	56	75.0	1.25		
Estelle	91	45	70.8	0.30		
Fort Brown	81	32	61.2	0.26		
Fort Clark	81	32	61.2	0.26		
Fort Davis	81	32	61.2	0.26		
Fort McIntosh	81	32	61.2	0.26		
Fort Ringgold	99	55	78.4	0.05		
Fredericksburg	84	44	65.6	3.30		
Gainesville	85	41	65.0	2.04		
Gatesville	86	43	66.8	2.10		
Georgetown	95	44	69.7	1.41		
Grapevine	89	43	66.8	2.63		
Greenville	90	42	66.2	7.91		
Hale Center	87	40	63.9	1.35		
Hallettsville	89	50	70.9	2.45		
Haskell	90	42	66.7	2.61		
Hearne	90	41	67.4	3.69		
Henrietta	89	41	66.2	2.79		
Hondo	89	52	69.9	2.92		
Houston	90	46	69.3	8.53		
Huntsville	89	39	64.8	0.96		
Ira	86	46	68.0	3.33		
Jacksonville	90	42	69.6	2.80		
Jasper	86	40	67.2	7.01		
Kaufman	86	40	67.2	7.01		
Kent	94	36	67.8	1.67		
Kerrville	90	42	66.0	2.40		
Kopperl	90	42	66.0	2.40		
Lampasas	90	42	66.0	2.40		
Lapara	90	42	66.0	2.40		
Laureles Ranch	89	50	69.6	2.95		
Llano	83	44	65.4	2.53		
Longview	88	48	68.0	2.77		
Luling	89	39	66.4	3.22		
Mann	89	44	69.1	1.05		
Marlin	92	37	65.6	1.26		
Menardville	90	37	62.4	1.17		
Mount Blanco	89	42	66.3	5.57		
Nacogdoches	88	49	69.2	2.04		
New Braunfels	86	43	65.0	3.80		
Paris	90	52	72.7	1.41		
Pearall	90	49	73.4	4.20		
Port Lavaca	90	37	65.0	2.95		
Rhineland	89	49	70.4	2.08		
Rock Island	86	61	74.2	2.90		
Rockport	92	53	73.0	2.70		
Runge	86	52	70.2	1.58		
Sabine	91	50	70.8	0.40		
Sanderson	89	45	67.4	1.51		
San Marcos	87	39	63.8	2.09		
Santa Saba	96	55	73.8	1.12		
Santa Gertrude Ranch	88	43	67.6	3.20		
Shaeffer Ranch	90	47	70.5	2.50		
Sherman	85	44	63.8	4.71		
Sugarland	84	45	66.8	2.48		
Sulphur Springs	84	43	66.6	2.49		
Temple	90	45	68.8	9.37		
Temple	88	45	65.7	2.87		
Trinity	94	54	73.0	0.98		
Tyler	85	46	66.8	3.40		
Victoria	94	40	65.3	3.40		
Waco	84	42	66.0	2.19		
Waxahachie	90	48	71.1	3.05		
Weathford	91	50	72.4	3.06		
Welman	91	50	72.4	3.06		
Wichita Falls	91	50	72.4	3.06		
Wharton	91	50	72.4	3.06		
<i>Utah.</i>	°	°	°	Inch.	Inch.	
Aneth	82	28	55.2	0.00		
Blackrock	79	21	49.4	0.53		
Bluecreek	75	38	49.4	0.20		
Castledale	79	19	49.3	0.00		
Cisco	74	30	53.2	0.00		
Corinne	82	26	52.6	0.61		
Coyote	79	15	45.7	0.18		
Deseret	85	19	50.8	0.20		
Emery	70	23	44.8	T.		
Escalante	78	28	51.6	0.21		
Farmington	75	30	50.7	0.32		
Fillmore	90	22	55.8	0.58		
Fort Duchesne	84	13	43.6	0.00		
Frisco	75	29	52.2	0.15		
Giles	79	22	50.2	0.05		
Government Creek	77	28	52.0	0.17		
Green River	90	25	55.9	0.03		
Grover	78	25	49.6	0.10		
Heber	79	20	46.2	0.45		
Henefer	76	17	44.1	0.52		
Hite	86	58	60.8	T.		
Huntsville	89	24	55.6	0.00		
Kanab	71	23	47.1	T.		
Kelton	72	26	49.8	T.		
La Sal	76	29	49.6	1.62		
Levan	71	8	40.2	0.00		
Loa	76	32	41.4	0.51		
Logan	78	26	49.6	0.40		
Manti	80	23	50.0	0.		

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.						Stations.						Stations.					
Temperature. (Fahrenheit.)			Precipitation.			Temperature. (Fahrenheit.)			Precipitation.			Temperature. (Fahrenheit.)			Precipitation.		
Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
Virginia—Cont'd.						West Virginia—Cont'd.						Wyoming—Cont'd.					
Rocky Mount	75	28	54.6	7.33		Magnolia	80	24	55.5	2.62		Irma	77	25	48.7	0.34	
Saxe	80	30	57.2	5.22		Martinsburg	80	27	55.4	4.55		Iron Mountain	74	20	46.5	0.53	
Shenandoah				3.49		Morgantown	76	32	57.2	3.95		Kimball Ranch	75	32	50.2	0.61	
Speers Ferry				2.17		Moscow	75	28	54.6	2.45		La Grange	86	19	51.6	0.20	
Spottsville	84	28	61.8	1.48		Moundsville	76	29	56.7	3.14		Laramie	71	19	44.4	0.74	
Staunton	82	29	58.4	3.54		Myra	97	27	59.5	1.87		Leo	69	18	43.4	0.15	
Stephens City				3.37		New Martinsville	81	29	58.2	2.70		Lolabama Ranch	73	16	41.0	0.62	
Warsaw	78	30	60.4	3.97		Nuttallburg	84	29	60.0	2.10		Lusk	82	16	47.1	0.70	
Wilkinson	79	31	60.8	5.92		Parsons	76	22	53.3	0.90		Moore	77	20	48.8	0.50	
Williamsburg	77	30	60.7	2.94		Philippi	86	24	55.0	2.35		Parkman	81	22	47.4	0.10	
Woodstock	82	26	55.6	3.15		Pickens	76	26	55.3	2.82		Pinebluff	81	25	48.8	0.68	
Wytheville	82	27	57.2	2.20		Point Pleasant	82	34	60.6	2.63		Rawlins	71	22	44.4	1.75	
Washington.						Princeton	78	25	54.9	2.65		Red Bank	78	25	49.2	0.45	
Aberdeen	82	35	51.6	6.21		Rippon	81	26	57.2	5.18		Rocksprings	74	19	47.8	0.04	
Anacortes				0.70		Romey	85	24	55.4	3.47		Saratoga	73	15	46.1	0.74	
Ashford				4.32		Rowlesburg				4.52		South Pass City	68	11	36.9		
Blaine	66	32	49.4	2.11		Southside	78	35	58.6	1.60		Thayne	74	14	41.2	0.43	
Bremerton	85	32	51.5	3.36		Terra Alta	75	22	52.8	5.50		Thermopolis	80	19	47.8	0.32	
Brinnon	73	39	53.1	4.22		Uppertract	81	24	56.0	2.21		Wheatland				0.71	
Cedonia	73	28	49.4	0.84		Wellsburg	74	30	54.2	3.30		Porto Rico.					
Centralia	83	30	53.0	2.69		Weston a				3.59		Adjuntas	90	53	73.1	13.52	
Cheney				0.61		Weston b	83	27	59.0			Aguadilla	88	65	78.2	5.46	
Clearwater	75	34	52.6	7.10		Wheeling a				3.53		Aguirre	91	68	80.1	6.08	
Cle Elum	79	24	47.5	0.79		Wheeling b	80	32	59.4	2.69		Arecibo	89			3.38	
Colfax	85	26	51.0	0.76		Williamson	84	30	59.1	2.53		Barros	87	54	73.4	4.46	
Colville	87	20	51.0	0.30		Wisconsin.						Bayamon	97	66	81.0	9.17	
Concouilly	71	26	48.3	0.31		Amherst	72	23	47.1	1.32		Caguas	92	54	74.6	4.36	
Coupeville	72	38	52.9	0.67		Antigo	78	20	46.6	1.57		Canovanas	91	70	80.0	1.91	
Crescent	78	24	49.0	0.46		Appleton	74	27	49.2	1.58		Cavey	96	56	77.4	3.43	
East Sound	69	35	51.4	1.65		Ashland				1.55		Cidra	90	54	74.6	3.90	
Ellensburg	77	23	48.6	0.74		Barron	76	24	49.4	0.68		Coamo	93	60	79.2	5.30	
Grandmound	83	32	52.8	2.31		Bayfield	66	31	45.8	2.56		Fajardo	91	67	79.2	3.21	
Granite Falls				2.21		Beloit	75	31	51.8	1.69		Guanica	93	65	78.7	3.19	
Hooper	86	28	54.3	0.42		Brodhead	76	28	53.2	1.44		Guayama				6.76	
Iliwaco	78	41	54.4	4.15		Butternut	69	19	41.1	3.06	0.5	Hacienda Armistad	94	58	77.0	3.19	
Lacenter	81	37	53.0	2.08		Chilton	72	24	47.9	2.37		Hacienda Coloso	91	60	76.8	6.52	
Lakeside	75	34	53.8	0.08		Darlington	75	21	49.6	9.16		Hacienda Perla	90	62	79.4	6.31	
Lind	90	29	54.9	0.26		Delavan	75	29	51.8	1.26		Humacao	90	76	82.9	4.94	
Lyle	83	35	54.4	0.92		Dodgeville	75	26	51.3	1.30		Isabela	88	65	77.2	3.24	
Mayfield	77	32	51.6	3.50		Downing	75	22	46.8	1.65		Juana Diaz	91	67	79.6	8.43	
Mottinger Ranch	79	37	57.4	0.46		Easton	75	24	49.5	1.52		La Isolina	90	60	76.4	7.31	
Mount Pleasant	79	38	54.7	2.08		Eau Claire	75	29	49.0	2.58		Manati	93	65	78.7	3.38	
Moxee Valley	83	25	50.6	0.91		Florence	67	19	43.6	1.61		Maunabo	96	68	79.8	8.82	
Oiga	65	44	52.2	1.70		Fond du Lac	72	27	50.4	1.42		Mayaguez	92	62	78.1	5.82	
Olympia	81	35	54.3	2.98		Grand River Locks				1.98		Morovis	95	63	78.0	12.74	
Pomeroy	89	32	55.4	0.81		Grantsburg	72	25	45.8	1.82		Ponce	91	65	79.8	4.76	
Port Townsend	69	41	52.8	0.51		Harvey	74	29	50.4	1.18		Rio Piedras				3.67	
Pullman	82	32	52.6	0.70		Hayward	68	20	45.0	2.40		San German	91	68	80.6	5.17	
Rattlesnake Mountains	73	30	53.0	1.03		Hillsboro	72	22	49.2	1.78		San Lorenzo	93	60	77.9	3.74	
Republic	79	20	47.6	0.66		Koepnick	84	15	45.3	2.20		San Salvador	90	58	75.4	6.93	
Ritzville				0.07		Ladysmith	71	22	46.0	2.61		Santa Isabel	92	67	79.5	5.04	
Ritzville (near)				0.29		Lancaster	75	26	51.4	1.12		Utua	93	61	77.5	11.33	
Rosalia	77	32	50.7	0.50		Madison	75	31	51.4	1.23		Vieques	90	72	81.9		
Sedro	82	32	52.8	0.00		Manitowoc	72	28	49.2	2.14		Yauco	88	66	77.8	3.58	
Silvana	83	31	52.8	2.30		Meadow Valley	78	24	48.6	1.36		Mexico.					
Snohomish	80	32	52.4	1.74		Medford	72	22	46.4	3.20		Ciudad P. Diaz	86	52	72.0	2.64	
Snoqualmie	80	36	52.6	3.50		Menasha				1.73		Leon de Aldamas	79	42	63.0	0.74	
Southbend	80	39	55.2	4.96		Neillsville	76	24	48.4	1.45		New Brunswick.					
Sprague				0.50		New Holstein	74	22	49.6	1.76		St. John	68	27	46.5	4.78	
Stampede				7.10		New London	75	21	48.2	2.57		Isthmus of Panama.					
Sunnyside	77	30	52.4	0.72		North Crandon	69	19	43.2	1.54		Alhajuela	90	71	78.4	11.26	
Trinidad	84	32	57.6	0.01		Oconto	76	26	48.4	2.23		La Boca	86	70	78.4	10.67	
Union	81	35	53.0	5.98		Osceola	74	22	45.7	1.23		West Indies.					
Usk	76	27	48.4	3.34		Oshkosh	73	25	50.3	2.22		Roseau, Dominica	91	72	79.3	4.71	
Vancouver	77	35	53.3	0.74		Pepin	70	32	51.0	2.46							
Vashon	70	42	52.6	2.84		Pine River	77	24	49.3	1.46							
Waterville	74	21	48.2	T.		Portage	75	29	51.8	1.51							
Wenatchee (near)	80	30	53.0	0.69		Port Washington	74	28	51.4	1.25							
Whitcom	69	31	51.1	1.29		Prairie du Chien a	87	29	56.5	1.22							
Wilbur	79	17	49.1	0.62		Prairie du Chien b				1.52							
Zindel	84	40	58.4	0.00		Prentice	71	21	44.6	3.01							
West Virginia.						Racine	79	32	54.3	1.39		Alabama.					
Addison	80	26	57.4	3.50		Sheboygan	74	28	52.6	1.73		Newburg	91	34	70.4	6.08	
Bayard	73	20	51.2	2.58		Stevens Point	75	22	47.4	1.37		Alaska.					
Beckley	72	31	51.5	1.72		Tomahawk	71	18	43.2	2.20		Coal Harbor	63	33	48.7	4.98	
Beverly	75	21	53.8	1.83		Valley Junction	82	25	51.4	2.34		Kcni	62	16	46.2	4.09	
Burlington	80	22	55.0	2.85		Viroqua	74	25	50.0	1.88		Minai Harbor	62	32	48.9	0.60	
Byrne	83	31	61.4	2.70		Watertown	73	26	49.4	1.10		Tyoonok	66	25	48.2	6.46	
Cairo	84	26	58.0			Waukesha											

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<p>EXPLANATION OF SIGNS.</p> <p>*Extremes of temperature from observed readings of dry thermometer.</p> <p>A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:</p> <p>¹Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.</p> <p>²Mean of 8 a. m. + 8 p. m. + 2.</p> <p>³Mean of 7 a. m. + 7 p. m. + 2.</p> <p>⁴Mean of 6 a. m. + 6 p. m. + 2.</p> <p>⁵Mean of 7 a. m. + 2 p. m. + 2.</p> <p>⁶Mean of readings at various hours reduced to true daily mean by special tables.</p> <p>The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.</p> <p>An italic letter following the name of a station, as "Livingston a," "Livingston b," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "a" denotes 14 days missing.</p> <p>No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.</p> <p>CORRECTIONS.</p> <p>December, 1901, page 583, third column, under Isthmus of Panama, make values at La Boca read 90°, 73°, 81.0°, instead of 86°, 74°, 79.2°.</p> <p>August, 1902, California, Hanford, make minimum and mean temperatures read 49° and 75.9°, instead of 41° and 71.9°, respectively.</p> <p>September, 1902, make minimum and mean temperatures read 40° and 74.2°, instead of 32° and 70.2°, respectively.</p>					
<i>Isthmus of Panama.</i>	°	°	°	<i>Ins.</i>	<i>Ins.</i>
Alhajucla.....	92	72	79.3	10.63	
La Boca.....	88	76	79.5	6.77	

TABLE III.—Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of October, 1902.

Stations.	Component direction from—				Resultant.		Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.		N.	S.	E.	W.	Direction from—	Duration.
<i>New England.</i>							<i>Upper Mississippi Valley.</i>						
Eastport, Me.	Hours.	Hours.	Hours.	Hours.	°	Hours.	St. Paul, Minn.	Hours.	Hours.	Hours.	Hours.	°	Hours.
Portland, Me.	21	19	7	31	n. 85 w.	24	La Crosse, Wis. †	18	23	18	18	s. 18 e.	5
Northfield, Vt.	21	20	6	28	n. 87 w.	22	Davenport, Iowa	11	14	6	5	s. 56 w.	11
Boston, Mass.	19	36	5	11	s. 19 w.	18	Des Moines, Iowa	11	17	18	27	s. 56 w.	4
Nantucket, Mass.	15	21	6	30	s. 76 w.	25	Dubuque, Iowa	18	20	18	21	s. 56 w.	4
Block Island, R. I.	21	18	14	21	n. 67 w.	8	Keokuk, Iowa	15	24	15	21	s. 34 w.	11
New Haven, Conn.	20	20	13	25	w.	12	Cairo, Ill.	16	23	16	22	s. 41 w.	9
<i>Middle Atlantic States.</i>							St. Louis, Mo.	14	29	16	14	s. 8 e.	15
Albany, N. Y.	19	25	11	20	s. 56 w.	11	Springfield, Ill.	11	27	14	25	s. 34 w.	9
Binghamton, N. Y. †	9	6	9	13	n. 53 w.	5	Hannibal, Mo. †	6	14	7	12	s. 32 w.	19
New York, N. Y.	22	12	14	28	n. 54 w.	17	St. Louis, Mo.	14	34	10	15	s. 14 w.	21
Harrisburg, Pa.	16	13	20	22	n. 34 w.	4	<i>Missouri Valley.</i>						
Philadelphia, Pa.	25	16	15	20	n. 29 w.	10	Columbia, Mo. *	7	14	10	9	s. 8 e.	7
Scranton, Pa.	22	18	17	22	n. 51 w.	6	Kansas City, Mo.	17	28	22	13	s. 39 e.	14
Atlantic City, N. J.	23	16	12	27	n. 65 w.	17	Springfield, Mo.	13	35	17	13	s. 10 e.	22
Cape May, N. J.	26	16	13	21	n. 39 w.	13	Topeka	6	17	7	5	s. 10 e.	11
Baltimore, Md.	27	15	10	24	n. 49 w.	18	Lincoln, Nebr.	22	24	16	8	s. 76 e.	8
Washington, D. C.	25	19	13	18	n. 40 w.	8	Omaha, Nebr.	21	27	12	16	s. 34 w.	7
Cape Henry, Va. *	10	11	8	9	s. 45 w.	1	Valentine, Nebr.	19	13	11	34	n. 75 w.	24
Lynchburg, Va.	23	14	17	21	n. 24 w.	10	Sioux City, Iowa †	13	10	7	8	n. 18 w.	3
Norfolk, Va.	18	25	22	12	s. 55 e.	12	Pierre, S. Dak.	22	12	19	19	n.	10
Richmond, Va.	25	20	10	15	n. 45 w.	7	Huron, S. Dak.	23	17	20	18	n. 18 e.	6
<i>South Atlantic States.</i>							Yankton, S. Dak. †	8	8	10	13	w.	3
Asheville, N. C.	23	22	16	17	n. 45 w.	1	<i>Northern Slope.</i>						
Charlotte, N. C.	26	17	22	12	n. 48 e.	14	Havre, Mont.	13	14	17	30	s. 86 w.	13
Hatteras, N. C.	29	9	30	9	n. 46 e.	29	Miles City, Mont.	21	21	12	20	w.	8
Kitty Hawk, N. C. †							Helena, Mont.	9	24	4	42	s. 69 w.	41
Raleigh, N. C.	24	17	18	23	n. 36 w.	9	Kalispell, Mont.	10	20	13	33	s. 63 w.	22
Wilmington, N. C.	23	10	29	14	n. 49 e.	20	Rapid City, S. Dak.	19	9	11	31	n. 63 w.	22
Charleston, S. C.	25	9	28	14	n. 41 e.	21	Cheyenne, Wyo.	21	14	6	34	n. 76 w.	29
Columbia, S. C.	30	11	26	14	n. 32 e.	22	Lander, Wyo.	13	28	8	28	s. 53 w.	25
Augusta, Ga.	30	8	25	19	n. 15 e.	23	North Platte, Nebr.	16	16	17	25	w.	8
Savannah, Ga.	31	7	27	12	n. 32 e.	28	<i>Middle Slope.</i>						
Jacksonville, Fla.	34	8	19	14	n. 11 e.	26	Denver, Colo.	15	28	25	4	s. 59 e.	25
<i>Florida Peninsula.</i>							Pueblo, Colo.	24	15	22	15	n. 38 e.	11
Jupiter, Fla.	23	16	21	16	n. 36 e.	9	Concordia, Kans.	14	31	11	13	s. 7 w.	17
Key West, Fla.	19	15	34	12	n. 80 e.	22	Dodge, Kans.	18	22	16	16	s.	4
Tampa, Fla.	33	10	26	11	n. 33 e.	28	Wichita, Kans.	16	40	5	7	s. 5 w.	24
<i>Eastern Gulf States.</i>							Oklahoma, Okla.	17	36	13	7	s. 18 e.	20
Atlanta, Ga.	22	10	29	14	n. 51 e.	19	<i>Southern Slope.</i>						
Macon, Ga. †	20	4	5	5	n.	16	Abilene, Texas	14	31	24	10	s. 39 e.	22
Pensacola, Fla. †	19	1	15	5	n. 29 e.	21	Amarillo, Tex.	16	34	11	15	s. 13 w.	18
Mobile, Ala.	41	9	13	9	n. 7 e.	32	<i>Southern Plateau.</i>						
Montgomery, Ala.	27	5	24	15	n. 22 e.	24	El Paso, Texas.	19	7	25	24	n. 5 e.	12
Meridian, Miss. †	14	3	17	6	n. 45 e.	16	Santa Fe, N. Mex.	19	24	23	14	s. 61 e.	10
Vicksburg, Miss.	18	12	36	7	n. 78 e.	30	Flagstaff, Ariz.	18	17	18	25	n. 82 w.	7
New Orleans, La.	37	8	31	5	n. 42 e.	29	Phoenix, Ariz.	12	10	30	21	n. 77 e.	9
<i>Western Gulf States.</i>							Yuma, Ariz.	14	16	21	21	s.	2
Shreveport, La.	15	23	29	8	s. 69 e.	22	Independence, Cal.	11	26	18	23	s. 18 w.	16
Fort Smith, Ark.	14	13	34	12	n. 87 e.	22	<i>Middle Plateau.</i>						
Little Rock, Ark.	17	23	20	16	s. 34 e.	7	Carson City, Nev.	18	18	14	26	w.	12
Corpus Christi, Tex.	17	14	34	7	n. 84 e.	27	Winnemucca, Nev.	31	10	22	16	n. 16 e.	22
Fort Worth, Tex.	12	30	21	14	s. 21 e.	19	Modena, Utah	6	18	12	37	s. 64 w.	28
Galveston, Tex.	25	15	32	7	n. 68 e.	27	Salt Lake City, Utah	23	22	22	13	n. 84 e.	9
Palestine, Tex.	18	22	28	4	s. 81 e.	24	Grand Junction, Colo.	18	16	20	26	n. 72 w.	6
San Antonio, Tex.	19	18	28	5	n. 88 e.	23	<i>Northern Plateau.</i>						
Taylor, Tex. †	10	10	7	9	w.	2	Baker City, Ore.	14	33	23	13	s. 28 e.	22
<i>Ohio Valley and Tennessee.</i>							Boise, Idaho	19	12	15	30	n. 65 w.	17
Chattanooga, Tenn.	19	18	17	23	n. 80 w.	6	Lewiston, Idaho †	1	14	10	10	s.	13
Knoxville, Tenn.	24	17	12	25	n. 62 w.	15	Pocatello, Idaho	6	26	20	26	s. 17 w.	21
Memphis, Tenn.	19	25	21	15	s. 45 e.	8	Spokane, Wash.	17	24	25	8	s. 68 e.	18
Nashville, Tenn.	16	28	12	18	s. 27 w.	13	Walla Walla, Wash.	9	37	10	16	s. 12 w.	29
Lexington, Ky. †	6	17	5	5	s.	11	<i>North Pacific Coast Region.</i>						
Louisville, Ky.	16	31	11	13	s. 8 w.	15	Neah Bay, Wash.	0	18	35	19	s. 42 e.	24
Evansville, Ind. †	6	16	7	7	s.	10	North Head, Wash.	15	28	26	8	s. 54 e.	22
Indianapolis, Ind.	16	28	14	18	s. 18 w.	13	Port Crescent, Wash. *	0	7	16	12	s. 30 e.	8
Cincinnati, Ohio	17	24	23	17	s. 41 e.	9	Seattle, Wash.	17	21	22	15	s. 60 e.	8
Columbus, Ohio	11	27	17	24	s. 24 w.	18	Tacoma, Wash.	22	23	12	22	s. 84 w.	10
Pittsburg, Pa.	22	18	12	28	n. 76 w.	16	Astoria, Ore.	11	29	19	21	s. 6 w.	18
Parkersburg, W. Va.	20	27	12	13	s. 8 w.	7	Portland, Ore.	20	20	16	22	w.	6
Elkins, W. Va.	20	13	11	28	n. 68 w.	18	Roseburg, Ore.	18	10	19	21	n. 14 w.	8
<i>Lower Lake Region.</i>							<i>Middle Pacific Coast Region.</i>						
Buffalo, N. Y.	14	18	14	26	s. 72 w.	13	Eureka, Cal.	19	24	14	17	s. 31 w.	6
Oswego, N. Y.	17	28	12	18	s. 29 w.	12	Mount Tamalpais, Cal.	19	25	10	28	s. 72 w.	19
Rochester, N. Y.	9	23	10	35	s. 61 w.	29	Red Bluff, Cal.	26	21	21	7	n. 70 e.	15
Syracuse, N. Y.	8	28	10	27	s. 40 w.	26	Sacramento, Cal.	15	30	22	10	s. 39 e.	19
Erie, Pa.	13	15	15	28	s. 81 w.	13	San Francisco, Cal.	0	19	8	40	s. 59 w.	37
Cleveland, Ohio	13	33	18	15	s. 9 e.	20	<i>South Pacific Coast Region.</i>						
Sandusky, Ohio †	4	14	6	14	s. 39 w.	13	Fresno, Cal.	15	13	9	34	n. 85 w.	25
Toledo, Ohio	14	21	13	27	s. 63 w.	16	Los Angeles, Cal.	15	8	11	34	n. 73 w.	24
Detroit, Mich.	17	20	16	26	s. 73 w.	10	San Diego, Cal.	36	7	6	27	n. 36 w.	36
<i>Upper Lake Region.</i>							San Luis Obispo, Cal.	17	14	5	25	n. 81 w.	20
Alpena, Mich.	21	17	9	27	n. 77 w.	18	<i>West Indies.</i>						
Escanaba, Mich.	18	22	9	26	s. 77 w.	18	Basseterre St. Kitts, W. I.	15	6	48	1	n. 79 e.	48
Grand Haven, Mich.	17	21	18	21	s. 37 w.	5	Bridgetown, Barbados	4	13	54	1	s. 81 e.	55
Houghton, Mich. †	8	6	11	12	n. 27 w.	2	Cienfuegos, Cuba	15	11	46	4	s. 85 e.	42
Marquette, Mich.	17	18	9	32	s. 88 w.	23	Colon, Columbia, S. A. †	6	25	6	6	s.	24
Port Huron, Mich.	18	19	13	26	s. 86 w.	13	Grand Turk, Turks Island †	1	15	19	3	s. 49 e.	21
Sault Ste. Marie, Mich.	24	11	21	21	n.	13	Hamilton, Bermuda	19	18	28	13	n. 86 e.	15
Chicago, Ill.	14	21	15	27	s. 60 w.	14	Havana, Cuba	11	14	43	3	s. 86 e.	40
Milwaukee, Wis.	13	16	15	30	s. 79 w.	15	Kingston, Jamaica	44	1	36	1	n. 39 e.	55
Green Bay, Wis.	20	24	16	20	s. 45 w.	6	Port of Spain, Trinidad, W. I. †	1	16	18	3	s. 45 e.	21
Duluth, Minn.	29	10	13	27	n. 36 w.	24	Puerto Principe, Cuba	25	12	32	11	n. 59 e.	25
<i>North Dakota.</i>							Roseau, Dominica, W. I. †	11	7	8	16	n. 63 w.	9
Moorhead, Minn.	23	22	20	14	n. 80 e.	6	San Juan, Porto Rico	1	40	29	6	s. 31 e.	45
Bismarck, N. Dak.	27	9	18	22	n. 13 w.	18	Santiago de Cuba, Cuba	29	22	20	6	s. 65 e.	17
Williston, N. Dak.	17	24	13	21	s. 49 w.	11	Santo Domingo, S. Dom., W. I.	49	7	12	5	n. 9 e.	43
							Willemstad	1	11	57	0	s. 81 e.	3

TABLE IV.—Thunderstorms and auroras, October, 1902.

States.	No. of stations.																																Total.					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No.	Days.				
Alabama.....	52	T.			3							2		2							3													10	4	T.		
Arizona.....	56	T.																																11	0	A.		
Arkansas.....	57	T.		1	2								2	3						1							5	2						16	7	T.		
California.....	167	T.						1														2	1	17	3									25	0	A.		
Colorado.....	81	T.									6	8	7	1					2				4	2		1					1	3		35	10	T.		
Connecticut.....	21	T.											2	1					1	2	4				1									11	6	A.		
Delaware.....	5	T.																																0	0	T.		
Dist. of Columbia.....	4	T.										1																						1	1	A.		
Florida.....	47	T.	1	2	2	1	1	1	1	2	5	5	5	1	1	10	7	4	1	7	4	5	5	2	3	2	1	3	2					84	27	T.		
Georgia.....	55	T.					1									2											1	4							8	4	A.	
Idaho.....	34	T.								1	2												1	1	2										7	0	T.	
Illinois.....	92	T.		1								36	9			5		14	7						1	12	2							92	10	A.		
Indiana.....	58	T.			1	1	6						13	15			13	3	5		2							21	1	1				82	12	T.		
Indian Territory.....	11	T.										3	2							2	1											1		9	5	A.		
Iowa.....	149	T.		1		1	1					1	23	1				34	11				6	1	13	15	20	5	2		1			136	16	T.		
Kansas.....	77	T.		2	5	2						11	12	1													5	4						48	10	A.		
Kentucky.....	41	T.										1		6			1	1										4	1					14	6	T.		
Louisiana.....	46	T.	1	6	9	1								1	1						4	8			3	1	1	2						38	12	A.		
Maine.....	19	T.														3				8	4													17	5	T.		
Maryland.....	48	T.					1					10	3					2										1						17	5	A.		
Massachusetts.....	48	T.										1	1							4	5								1					13	6	T.		
Michigan.....	106	T.					14			2			6	11				1	1	6	1	11	4	24	3		6	30	1					126	16	A.		
Minnesota.....	67	T.															1		5	1			10	2	15	3	24	13						80	9	T.		
Mississippi.....	44	T.		2	12	1								7	1						1	3												27	7	A.		
Missouri.....	95	T.	1	1	2	3	3					1	3	34	2			1	20	9				1			3	5	2					93	18	T.		
Montana.....	40	T.								3																									3	1	A.	
Nebraska.....	142	T.		1	2	3					1	3	26	9					1					1	9	1	12	2						74	14	T.		
Nevada.....	40	T.									1														1										2	0	A.	
New Hampshire.....	19	T.												1	3					2	9	5												21	6	T.		
New Jersey.....	51	T.											12				2	4	1	1														20	5	A.		
New Mexico.....	31	T.	1	1	1								1		1					2														12	8	T.		
New York.....	99	T.				1	1	3	1					3	33	12				37	45	7		1		29	1		2					183	16	A.		
North Carolina.....	56	T.	1			2	2	1				1	2																						12	1	T.	
North Dakota.....	48	T.										1	2																						24	1	A.	
Ohio.....	128	T.	3		1		17	1					2	6	25			8	6	19			1					21	4					114	13	T.		
Oklahoma.....	23	T.		1		4	1		3				5							1															17	8	A.	
Oregon.....	74	T.								1							1																		6	5	T.	
Pennsylvania.....	91	T.				1	5						1	2	7			3	3	6	2				1									31	10	A.		
Rhode Island.....	7	T.												1	1																				3	3	T.	
South Carolina.....	46	T.	3			3	1	1				1																							13	8	A.	
South Dakota.....	56	T.															1	1																	33	7	T.	
Tennessee.....	56	T.			1								1		10										10			5	1						13	4	A.	
Texas.....	95	T.	5	19	10	1									2	4					21	1						1	9		4	7	1		85	13	T.	
Utah.....	47	T.									3	3	1											3		2									15	7	A.	
Vermont.....	16	T.																		2	9	1					4							25	7	T.		
Virginia.....	50	T.											9	1																					11	3	A.	
Washington.....	64	T.																								1	1								5	4	T.	
West Virginia.....	43	T.					1					1	1	3			5	8			1						1								22	9	A.	
Wisconsin.....	60	T.				1							5		1				4	2			11	7	7	3	5	7	1						54	0	T.	
Wyoming.....	31	T.											2																							2	1	A.
Sums.....	2,893	T.	16	37	52	26	55	8	6	8	8	23	99	183	149	40	13	37	108	119	117	63	39	49	86	77	114	137	36	5	26	33	31	1,800	21	T.		
		A.	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	2	2	3	4	5	21	A.		

02

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.														
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.	
Albany, N. Y.	27-28			1.46																0.27		
Alpena, Mich.	12-13			0.95																*		
Atlanta, Ga.	4-5			0.68																0.48		
Atlantic City, N. J.	11-12			2.35																0.45		
Augusta, Ga.	26-27			1.22																*		
Baltimore, Md.	1-5			2.79																0.50		
Binghamton, N. Y.	27-28			1.28																0.15		
Bismarck, N. Dak.	24-25			0.51																0.37		
Boise, Idaho.	23			0.43																0.33		
Boston, Mass.	28			1.84																0.30		
Buffalo, N. Y.	22-23			0.64																0.28		
Cairo, Ill.	3			0.77																0.11		
Charleston, S. C.	10-11			1.80																0.61		
Charlotte, N. C.	4-5	6:05 p. m.	8:55 a. m.	1.72	6:45 p. m.	7:10 p. m.	0.11	0.09	0.23	0.33	0.36	0.45	0.49							0.49		
Chattanooga, Tenn.	10-11			1.82																*		
Chicago, Ill.	25			0.71																		
Cincinnati, Ohio.	16			0.52						0.35												
Cleveland, Ohio.	26			0.69																0.20		
Columbia, Mo.	17	D. N.	D. N.	0.84	3:28 a. m.	3:47 a. m.	0.04	0.16	0.26	0.45	0.62	0.66	0.69	0.71	0.73					0.60		
Columbia, S. C.	10-11			1.44																0.25		
Columbus, Ohio.	3-4			1.34																0.51		
Corpus Christi, Tex.	3			1.01																0.36		
Davenport, Iowa.	17-18			1.48																0.04		
Denver, Colo.	1-2			0.40																0.86		
Des Moines, Iowa.	17-18	5:55 p. m.	D. N.	1.65	7:55 p. m.	8:35 p. m.	0.06	0.11	0.18	0.46	0.52	0.60	0.70	0.73	0.77	0.79	0.82					
Detroit, Mich.	26			0.30												0.30				0.11		
Dodge, Kans.	2-3			1.68																*		
Dubuque, Iowa.	24-25			1.18																0.29		
Duluth, Minn.	23			0.74																0.40		
Eastport, Me.	28			1.39																0.24		
Elkins, W. Va.	11-12			1.05																0.45		
Erie, Pa.	5-6			1.																		

TABLE V.—Accumulated amounts of precipitation for each 5 minutes, etc.—Continued.

[illegible]

† September 30 to October 1.

TABLE VI.—Data furnished by the Canadian Meteorological Service, October, 1902.

[illegible]

TABLE VII.—Heights of rivers referred to zeros of gages, October, 1902.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
Mississippi River.	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>	Tennessee River.—Cont'd.	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>
St. Paul, Minn.	1,954	14	2.3	30,31	1.7	20,21	2.0	0.6	Bridgeport, Ala.	402	24	2.1	3	0.2	30,31	1.1	1.9
Reeds Landing, Minn.	1,884	12	1.3	30,31	0.7	20,25	1.0	0.6	Florence, Ala.	255	16	1.7	2	-0.2	31	0.9	1.9
La Crosse, Wis.	1,819	12	2.2	1-3,31	1.8	17,22-24	2.0	0.4	Verterton, Ala.	225	25	1.9	2	-1.2	31	0.5	3.1
Prairie du Chien, Wis.	1,759	18	1.8	2,3	1.4	20-27	1.5	0.4	Johnsonville, Tenn.	95	24	3.5	2,3	0.7	31	2.2	2.8
Dubuque, Iowa.	1,699	15	2.7	2	2.0	23,24	2.3	0.7	Cumberland River.								
Leclaire, Iowa.	1,609	10	1.7	1	1.1	13,14,17	1.3	0.6	Burnside, Ky.	516	50	3.9	14	1.5	31	2.3	2.4
Davenport, Iowa.	1,593	15	3.0	2,18-21	2.4	24,29-31	2.7	0.6	Carthage, Tenn.	305	40	4.6	14	0.8	31	2.2	3.8
Muscatine, Iowa.	1,562	16	4.1	19,20	3.1	25,30,31	3.5	1.0	Nashville, Tenn.	189	40	6.8	15	1.7	31	3.6	5.1
Galland, Iowa.	1,472	8	4.3	20	2.0	31	2.8	2.3	Clarksville, Tenn.	126	42	8.4	16	2.6	31	5.0	5.8
Keokuk, Iowa.	1,463	15	8.8	22	3.8	31	6.1	5.0	Arkansas River.								
Hannibal, Mo.	1,402	13	10.2	23,24	4.9	31	7.4	5.3	Wichita, Kans.	832	10	2.4	2-7	1.4	30	1.8	1.0
Grafton, Ill.	1,366	23	12.4	26	8.6	31	10.5	3.8	Webbers Falls, Ind. T.	465	23	8.8	9	1.9	30,31	4.5	6.9
St. Louis, Mo.	1,264	30	20.8	9	11.6	31	16.8	9.2	Fort Smith, Ark.	403	22	9.3	1	3.0	31	5.6	6.3
Chester, Ill.	1,189	30	17.0	10	9.4	31	13.4	7.6	Dardanelle, Ark.	256	21	9.5	1	1.9	31	5.2	7.6
New Madrid, Mo.	1,003	34	17.2	12	10.8	1	14.4	6.4	Little Rock, Ark.	176	23	11.5	1	3.3	31	6.7	8.2
Memphis, Tenn.	843	33	12.8	14	4.4	1	9.7	8.4	White River.								
Helena, Ark.	767	42	18.6	15	6.9	1	14.6	11.7	Newport, Ark.	150	26	1.3	12	0.3	31	0.9	1.0
Arkansas City, Ark.	635	42	20.3	17	6.8	1	15.9	13.5	Yazoo River.								
Greenville, Miss.	595	42	16.3	17	6.0	1	12.6	10.3	Yazoo City, Miss.	80	25	1.5	8,9	-2.1	30,31	-0.5	3.6
Vicksburg, Miss.	474	45	17.2	18,19	4.8	3	12.7	12.4	Red River.								
New Orleans, La.	108	16	6.5	23	3.7	2	4.9	2.8	Arthur City, Tex.	638	27	13.4	4	4.7	30,31	7.0	8.7
Yellowstone River.									Fulton, Ark.	515	28	19.5	6,7	6.4	31	12.4	13.1
Glendive, Mont.	98	17	0.9	2,3	-0.1	30,31	0.4	1.0	Shreveport, La.	327	29	14.2	1	5.2	31	9.5	9.0
James River.									Alexandria, La.	118	33	13.0	4	4.3	31	9.1	8.7
Lamoure, N. Dak.	25	-1.1	1-3	-1.9	27,31	-1.4	0.8		Ouachita River.								
Huron, S. Dak.	210	9	0.5	1,2	0.1	21-23	0.3	0.4	Camden, Ark.	304	39	14.8	7	4.5	29-31	7.3	10.3
Missouri River.									Monroe, La.	122	40	14.1	1	2.8	30,31	7.4	11.3
Townsend, Mont.	2,504	10	3.8	18-31	3.6	1-8	3.7	0.2	Achafalaya River.								
Fort Benton, Mont.	2,285	12	1.0	30,31	0.5	1	0.9	0.5	Melville, La.	100	31	18.5	18-20	9.2	1	15.3	9.3
Buford, N. Dak.	1,309	14	0.9	17	0.4	15,16	0.6	0.5	Susquehanna River.								
Bismarck, N. Dak.	1,114	14	1.5	31	1.3	24-28	1.4	0.2	Ringhamton, N. Y.	306	16	9.1	29	3.2	25-27	4.1	5.9
Pierre, S. Dak.	784	19	6.1	1	5.6	26-28,30,31	5.8	0.5	Towanda, Pa.	262	16	6.9	29	1.6	27	2.8	5.3
Sioux City, Iowa.	669	18	6.7	1	5.5	31	6.0	1.2	Wilkesbarre, Pa.	183	17	12.2	30	4.6	27	6.7	7.6
Omaha, Nebr.	481	10	4.2	16	1.8	31	2.7	2.4	Harrisburg, Pa.	69	17	6.0	2,31	2.2	25	3.9	3.8
St. Joseph, Mo.	388	21	14.9	7	7.7	31	10.9	7.2	West Branch Susquehanna.								
Kansas City, Mo.	199	20	14.5	8	8.2	31	11.7	6.3	Lock Haven, Pa.	65	12						
Boonville, Mo.	103	24	16.3	8	7.4	31	12.1	8.9	Williamsport, Pa.	39	20	4.1	2	0.9	26,27	1.7	3.2
Hermann, Mo.									Juniata River.								
Illinois River.									Huntingdon, Pa.	90	24	4.7	28	3.0	4,5,8-11	3.3	1.7
Peoria, Ill.	135	14	14.3	9-11,16,17	12.1	1	13.6	2.2	Potomac River.								
Youghiogheny River.									Cumberland, Md.	290	8	3.8	13	1.1	1,27	2.0	2.7
Confluence, Pa.	59	10	2.0	7,12	0.5	3,30,31	1.1	1.5	Harpers Ferry, W. Va.	172	18	1.8	15,16	-0.8	28	0.0	2.6
West Newton, Pa.	15	23	5.6	12	0.2	1,2	1.1	5.4	James River.								
Allegheny River.									Lynchburg, Va.	260	18	4.0	5	-0.1	1-4,23-31	0.5	4.1
Warren, Pa.	177	14	1.3	9,15	0.0	1	0.7	1.3	Richmond, Va.	111	12	12.0	6	-0.6	2	0.8	12.6
Oil City, Pa.	123	13	2.0	16	0.4	1	1.3	1.6	Roanoke River.								
Parker, Pa.	73	20	2.4	8,9	0.7	29	1.6	1.7	Weldon, N. C.	129	30	35.5	8	8.7	25,26	3.8	26.8
Monongahela River.									Cape Fear River.								
Weston, W. Va.	161	18	3.0	14	-1.2	25-27	-0.2	4.2	Fayetteville, N. C.	112	38	8.0	14	1.6	27	3.8	6.4
Fairmont, W. Va.	119	25	5.1	12	1.0	9-11	1.6	4.1	Edisto River.								
Greensboro, Pa.	81	18	9.8	12,13	6.5	26-30	7.5	3.3	Edisto, S. C.	75	6	4.0	20-22	2.3	1-6	3.3	1.7
Lock No. 4, Pa.	40	28	13.0	13	5.9	29	8.3	7.1	Pedee River.								
Chenango River.									Cheraw, S. C.	149	27	19.3	7	1.6	26	4.2	17.7
Johnstown, Pa.	64	7	5.5	12	0.9	3,4	2.2	4.6	Black River.								
Red Bank Creek.									Kingstree, S. C.	52	12	1.1	20-24	-0.4	3-7	0.5	1.5
Brookville, Pa.	35	8	0.5	1-31	0.5	1-31	0.5	0.0	Lynch Creek.								
Beaver River.									Effingham, S. C.	35	12	4.3	20,21	2.7	1	3.5	1.6
Elwood Junction, Pa.	10	14	3.5	12-14,17,18	2.5	1-5	3.2	1.0	Santee River.								
Great Kanawha River.									St. Stephens, S. C.	97	12	7.0	11	1.6	27	4.8	5.4
Charleston, W. Va.	58	30	7.2	8	5.2	9	6.5	2.0	Ongaree River.								
Little Kanawha River.									Columbia, S. C.	37	15	8.5	28	-0.2	19,26	1.4	8.7
Glenville, W. Va.	103	20	3.5	12	-1.8	31	0.5	5.3	Wateree River.								
New River.									Camden, S. C.	45	24	15.2	6	4.6	25,26	7.7	10.6
Hinton, W. Va.	95	14	2.5	7	1.1	25-27	1.4	1.4	Waccamaw River.								
Cheat River.									Conway, S. C.	40	7	3.0	11	1.1	30	2.1	1.9
Rowlesburg, W. Va.	36	14	4.5	2	1.6	11,27	2.6	2.9	Savannah River.								
Ohio River.									Calhoun Falls, S. C.	347	15	4.0	27	2.0	26	2.9	2.0
Pittsburg, Pa.	966	22	8.5	13	3.7	16	5.9	4.8	Augusta, Ga.	268	32	10.9	7	6.9	23	8.3	4.0
Davis Island Dam, Pa.	960	25	9.2	13	2.7	2,3	4.3	6.5	Broad River.								
Wheeling, W. Va.	875	36	10.5	14	2.9	30,31	5.0	7.6	Carlton, Ga.	30	11	3.9	1	2.2	25-27	2.6	1.7
Parkersburg, W. Va.	785	36	9.8	15	2.7	1	5.9	7.1	Flint River.								
Point Pleasant, W. Va.	703	39	9.1	16	2.3	2,3,31	4.1	6.8	Albany, Ga.	80	20	2.2	1	0.4	20	1.4	1.8
Huntington, W. Va.	660	50	12.2	17	4.5	1	7.0	7.7	Chattahoochee River.								
Catlettsburg, Ky.	651	50	11.5	17	1.8	1	5.2	9.7	Westport, Ga.	239	20	3.8	1	1.9	25,26	2.5	1.9
Portsmouth, Ohio.	612	50	11.7	17	3.0	1	6.5	8.7	Ocmulgee River.								
Cincinnati, Ohio.	499	50	12.3	19	4.4	1	7.6	7.9	Macon, Ga.	125	18	5.6	2	3.1	25,26	4.0	2.5
Madison, Ind.	413	46	10.4	20	4.0	1,2	7.1	6.4	Oconee River.								
Louisville, Ky.	367	28	6.1	20,21	3.4	1	4.5	2.7	Dublin, Ga.	79	30	2.9	6	-0.6	25,26	1.1	3.5
Evansville, Ind.	184	35	7.4	24	2.4	2	4.8	5.0	Coosa River.								
Paducah, Ky.	47	40	6.9	12,13	2.9	1	5.3	4.0	Rome, Ga.	271	30	2.3	11	0.2	27	1.1	2.1
Cairo, Ill.	1,073	45	20.0	12	13.0	1	17.0	7.0	Gadsden, Ga.	144	18	3.4	13	-0.8	31	0.4	4.2
Muskingum River.									Alabama River.								
Zanesville, Ohio.	70	20	7.6	7	5.7	26,28-31	6.3	1.9	Montgomery, Ala.	265	35	6.6	1	0.1	27	2.1	6.5
Scioto River.									Selma, Ala.	212	35	6.0	14	-0.1	29	2.7	6.1
Columbus, Ohio.	110	17	4.0	6-8	2.1	31	2.9	1.9	Tombigbee River.								
Miami River.									Columbus, Miss.	303	33	-0.6	4	-3.3	29-31	-2.4	2.7

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—Hourly observations at the Observatory, San Jose de Costa Rica, during October, 1902.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	Duration, 1902.
	660+ Mm.	660+ Mm.	° C.	° C.	%	%	Mm.	Mm.	Hrs.
1 a. m.	4.15	3.39	17.32	17.43	94	95	0.1	4.1	0.50
2 a. m.	3.81	2.92	16.97	17.25	95	95	0.1	3.6	
3 a. m.	3.48	2.63	16.75	17.12	93	95	0.2	3.1	
4 a. m.	3.34	2.55	16.56	16.86	92	95	0.2	2.2	1.00
5 a. m.	3.33	2.67	16.33	16.80	94	95	2.4	1.7	0.17
6 a. m.	3.57	3.01	16.28	16.55	94	95	0.1	1.6	0.33
7 a. m.	3.89	3.46	16.48	16.87	92	93	2.0		
8 a. m.	4.22	3.77	18.55	18.65	81	87	1.8		
9 a. m.	4.46	3.98	20.95	20.17	72	80	0.7		
10 a. m.	4.56	4.20	23.16	22.60	67	74	0.4		
11 a. m.	4.41	4.02	24.64	24.08	62	70	2.4	0.8	0.67
Noon	4.13	3.46	25.42	24.61	60	70	0.1	2.7	1.00
1 p. m.	3.43	2.93	25.46	24.42	65	72	9.0	6.9	0.50
2 p. m.	2.91	2.34	24.13	23.85	69	74	15.4	17.0	1.17
3 p. m.	2.53	1.98	23.06	22.81	75	78	54.6	32.1	4.58
4 p. m.	2.44	1.85	21.93	21.38	81	84	13.4	36.8	6.27
5 p. m.	2.66	2.17	20.71	20.31	84	87	13.4	53.0	9.24
6 p. m.	2.99	2.48	19.74	19.32	88	89	22.5	46.6	7.01
7 p. m.	3.32	2.95	19.17	18.90	92	93	18.7	43.9	12.75
8 p. m.	3.85	3.56	18.76	18.56	92	93	22.1	22.6	9.50
9 p. m.	4.27	3.80	18.48	18.36	92	93	16.7	15.0	6.66
10 p. m.	4.45	4.04	18.14	18.14	93	94	2.5	11.9	3.84
11 p. m.	4.54	4.03	17.89	17.86	93	94	0.4	8.7	1.33
Midnight	4.37	3.80	17.64	17.50	93	94	0.1	5.7	1.33
Mean	663.70	663.17	19.77	19.58	84	87			
Minimum	661.0	665.53	14.3	13.3	42				
Maximum	665.9	666.12	28.2	29.3	100				
Total							188.1	325.0	67.85

REMARKS.—At San Jose the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds in advance of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San Jose local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1902.	Normal, 1889-1900.	Observed, 1902.	Normal, 1889-1900.	0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	Hours.	%	%	° C.	° C.	° C.	° C.	° C.
7 a. m.	7.57	6.01	63	60	21.39	21.60	22.26	22.02	21.84
8 a. m.	23.65	17.68							
9 a. m.	24.75	20.99							
10 a. m.	23.29	20.90	66	65	21.63	21.78	22.39	22.15	
11 a. m.	23.12	18.57							
Noon	18.83	14.09							
1 p. m.	16.28	11.39	82	83	22.20	21.99	22.42	22.08	
2 p. m.	13.99	10.86							
3 p. m.	8.46	8.35							
4 p. m.	6.17	4.73	90	95	22.42	22.04	22.43	22.06	
5 p. m.	2.37	1.85							
6 p. m.	0.17	0.23							
7 p. m.			90	93	22.20	22.07	22.30	22.00	
8 p. m.									
9 p. m.									
10 p. m.			65	83	22.04	22.05	22.32	21.99	
11 p. m.									
Midnight									
Mean			75	80	21.98	21.96	22.38	22.05	21.84
Total	168.63	135.65							

TABLE 3.—Rainfall at stations in Costa Rica, October, 1902.

Stations.	Height above sea level.	Observed, 1902.		Averages.	
		Amount.	Number of days.	Amount.	Number of days.
	Meters.	Mm.		Mm.	
Sipurio (Talamanca)	60	70	18	301	23
Boca Banano	3	81	10	163	16
Port Limon	3	143	10	125	11
Swamp Mouth	3			137	13
Zent	20	61	7	146	16
Siquirres	60	15	10	255	11
Dos Novillos	122	200	21		
Guapiles	300			489	21
Cariblanco (Sarapiquí)	835	187	29	644	
San Carlos	161	305	23	463	24
Las Lomas	266	79	20	393	25
Peralta	332	361	22	315	25
Turrialba	620	203	18	241	19
Juan Vinas	1,040	91	16	236	14
Santiago	1,100	186	18	256	25
Paraiso	1,336	23	10	226	20
Cachi	1,020	183	23		
Las Concavas	1,337	134	19	366	18
Tres Rios	1,300	333	27	399	22
San Isidro Arenilla					
San Francisco Guadalupe	1,187		6	336	23
San Jose	1,160	679	26	737	26
La Verbena	1,140	193	29	406	23
Nuestro Amo	791		6	306	20
Alajuela	950	278	16	482	24
San Isidro Alajuela	1,346	462	25	698	26

TABLE 4.—Observations taken at Port Limon and Zent, October, 1902.

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	Inches.	Inches.	° C.	° C.	° C.	%
Port Limon	755.17	760.27	75.73	33.1	25.79	25.85	85
Zent				20.0	35.0	25.85	86
Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	0.15 m.	0.30 m.	0.60 m.
	%	Hours.	Mm.		° C.	° C.	° C.
Port Limon	65		143.0	10	27.99	27.76	27.57
Zent	55	156.93	61.0	7			

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

October, 1902.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	Inch.	° F.	° F.	° F.	%	Inch.		
Chihuahua	4,684	25.26	82.4	50.9	66.6	57	0.43	e.	
Guadalajara (Obs. del Est.)	5,186	24.91	81.5	50.0	70.9	67	2.16	ne.	
Guanajuato	6,640	23.67	84.2	44.4	63.5	58	0.54	ene.	
Leon (Guanajuato)	5,906	24.27	79.0	42.4	63.3	70	0.70	ese.	e.
Mazatlan	25	29.82	89.6	73.0	82.2	77	0.44	nw.	
Merida	50	29.83	98.6	59.0	73.8	75	10.91	ne.	
Mexico (Obs. Cent.)	7,472	23.03	75.0	41.9	59.2	64	1.14	n.	ne.
Mexico (E. N. Agric.)	7,442	23.01	76.3	50.0	62.1	70		nw.	
Monterey (Seminario)	1,626	28.19	97.7	53.6	73.6	69	1.84	se.	
Morelia (Seminario)	6,401	23.93	77.0	45.0	64.0	75	3.11	s.	sw.
Puebla (Col. d Est.)	7,118	23.32	79.2	41.4	58.8	73	4.26	n.	
Queretario	6,070	24.14	80.2	45.5	63.0	62	0.78	e.	
Toluca	8,812	21.94	68.5	37.4	54.0	66	2.29	n.	
Zacatecas	8,015	22.55	74.8	39.2	57.9	63	3.06	e.	
Zapotlan	5,078	25.04	82.9	50.0	67.5	71	3.94	ese.	

*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of High Areas. October, 1902.

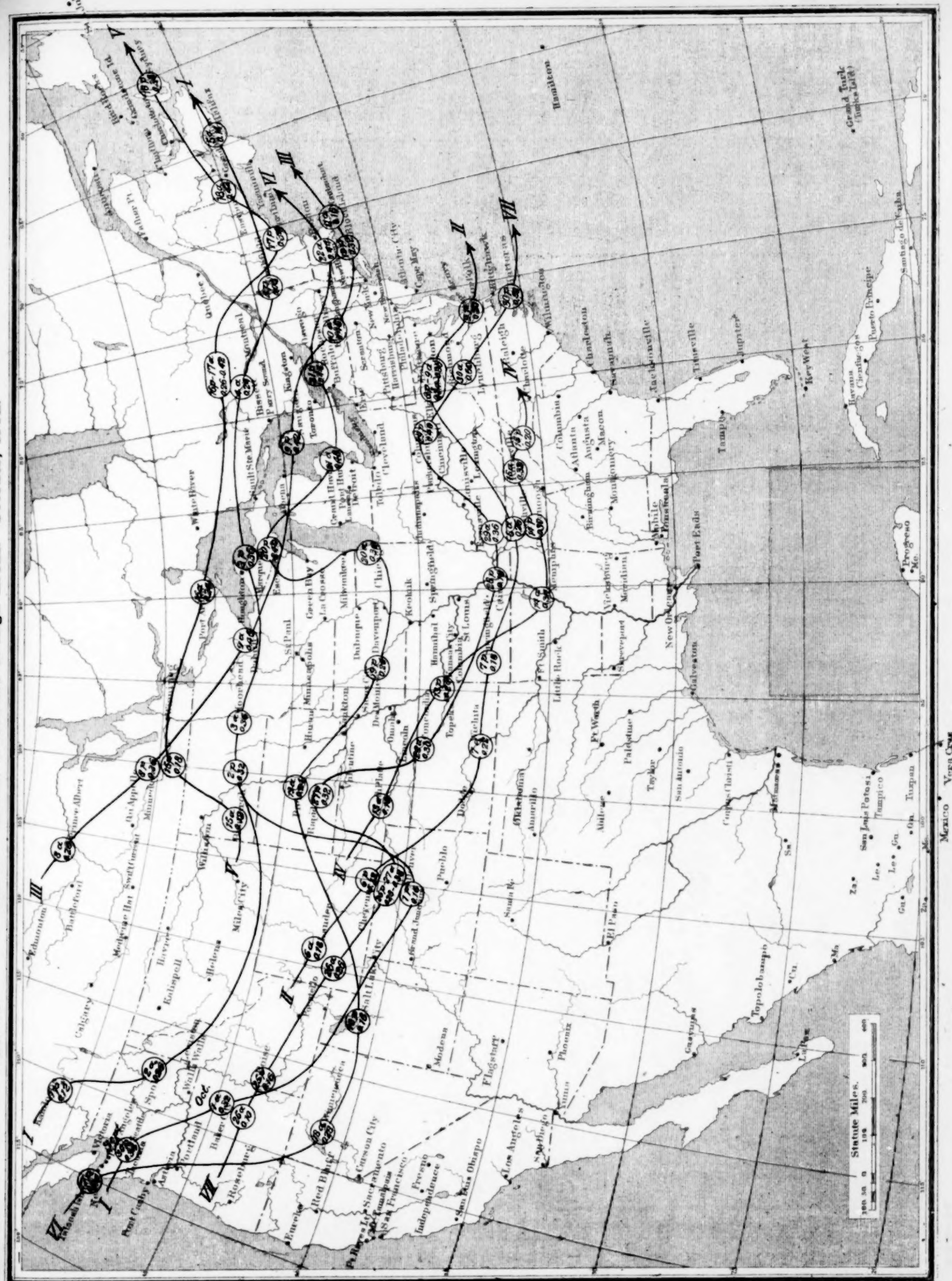


Chart II. Tracks of Centers of Low Areas. October, 1902.

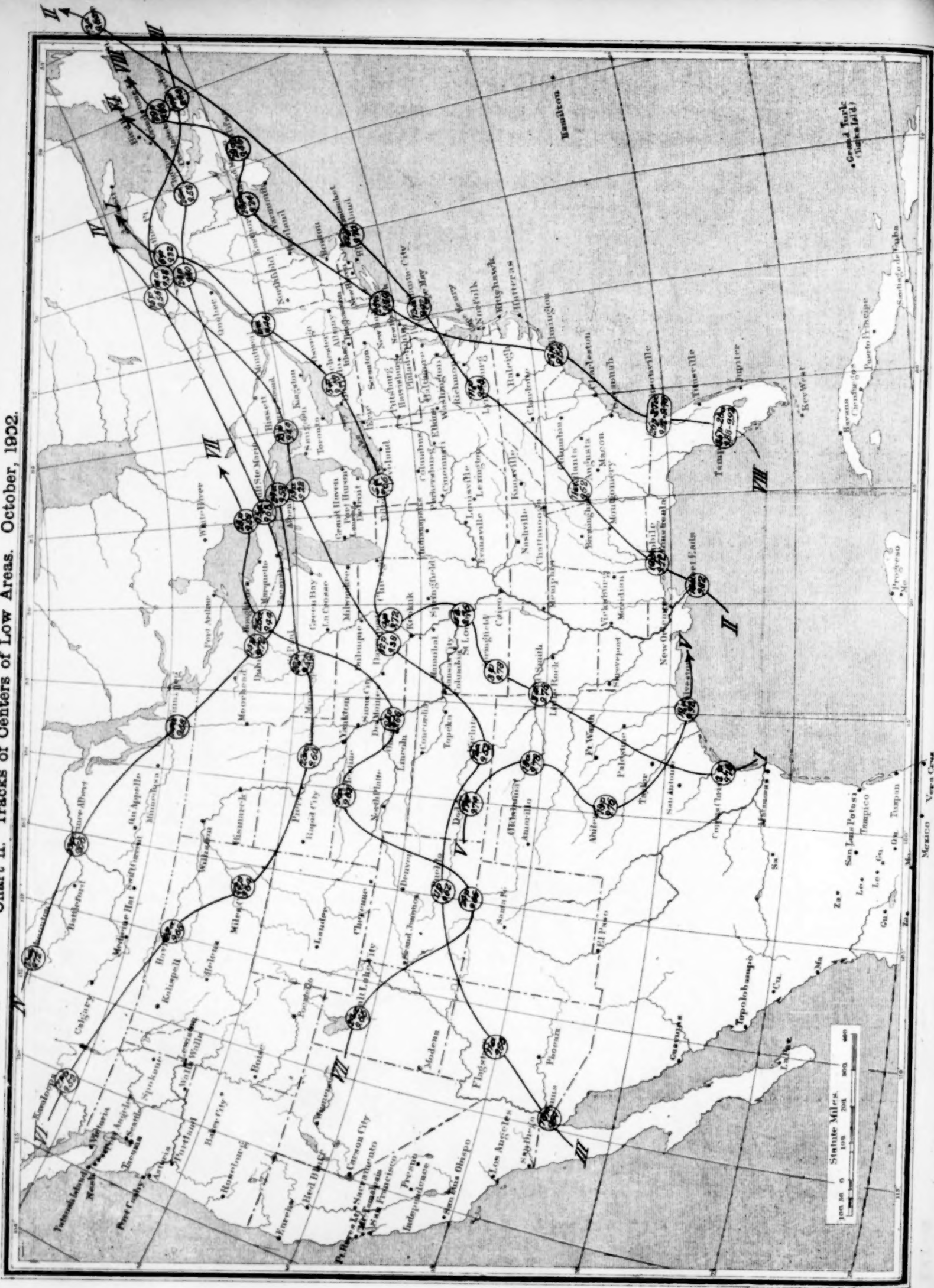


Chart III. Total Precipitation. October, 1902.

Chart III. Total Precipitation. October, 1902.

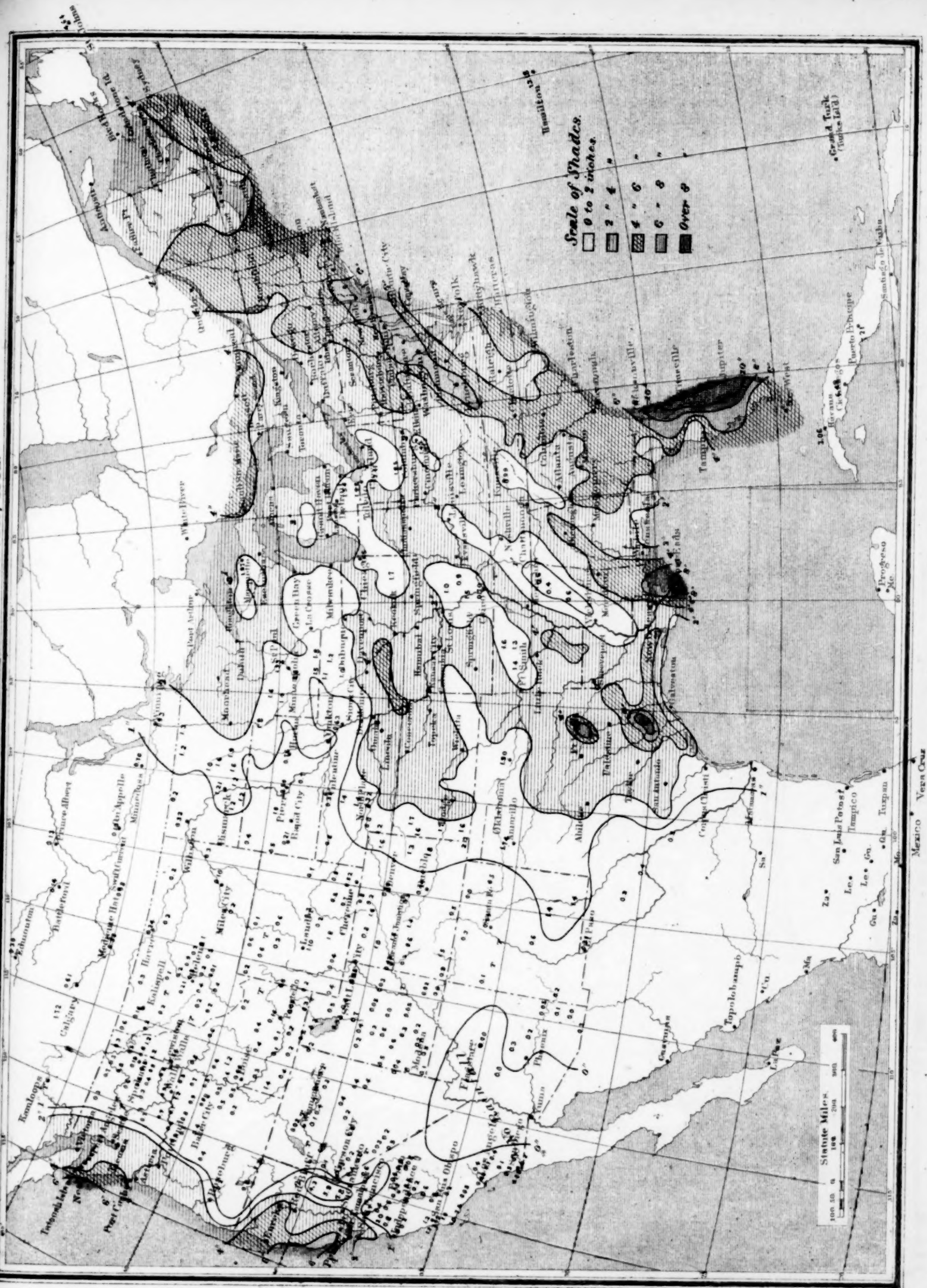
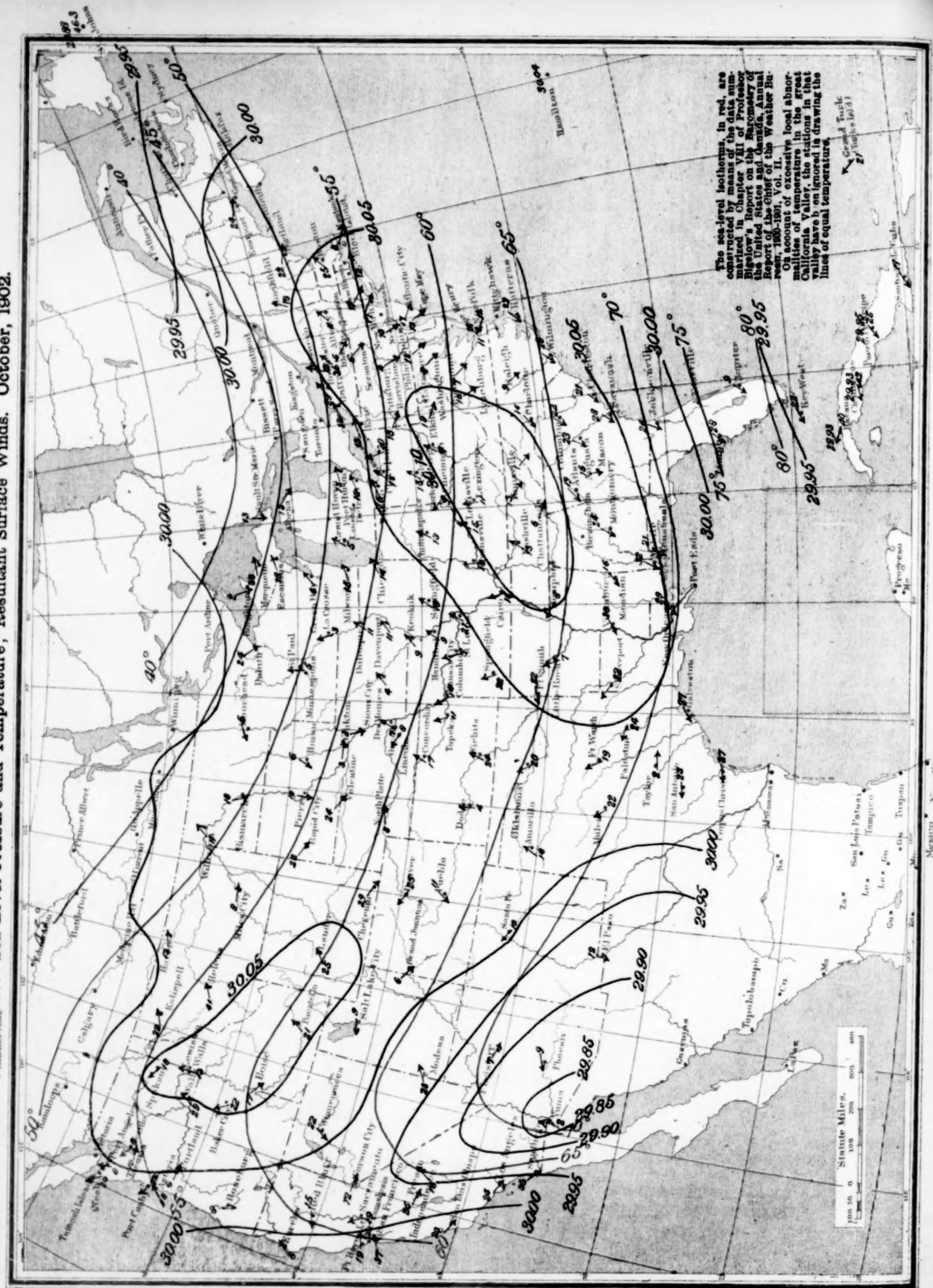
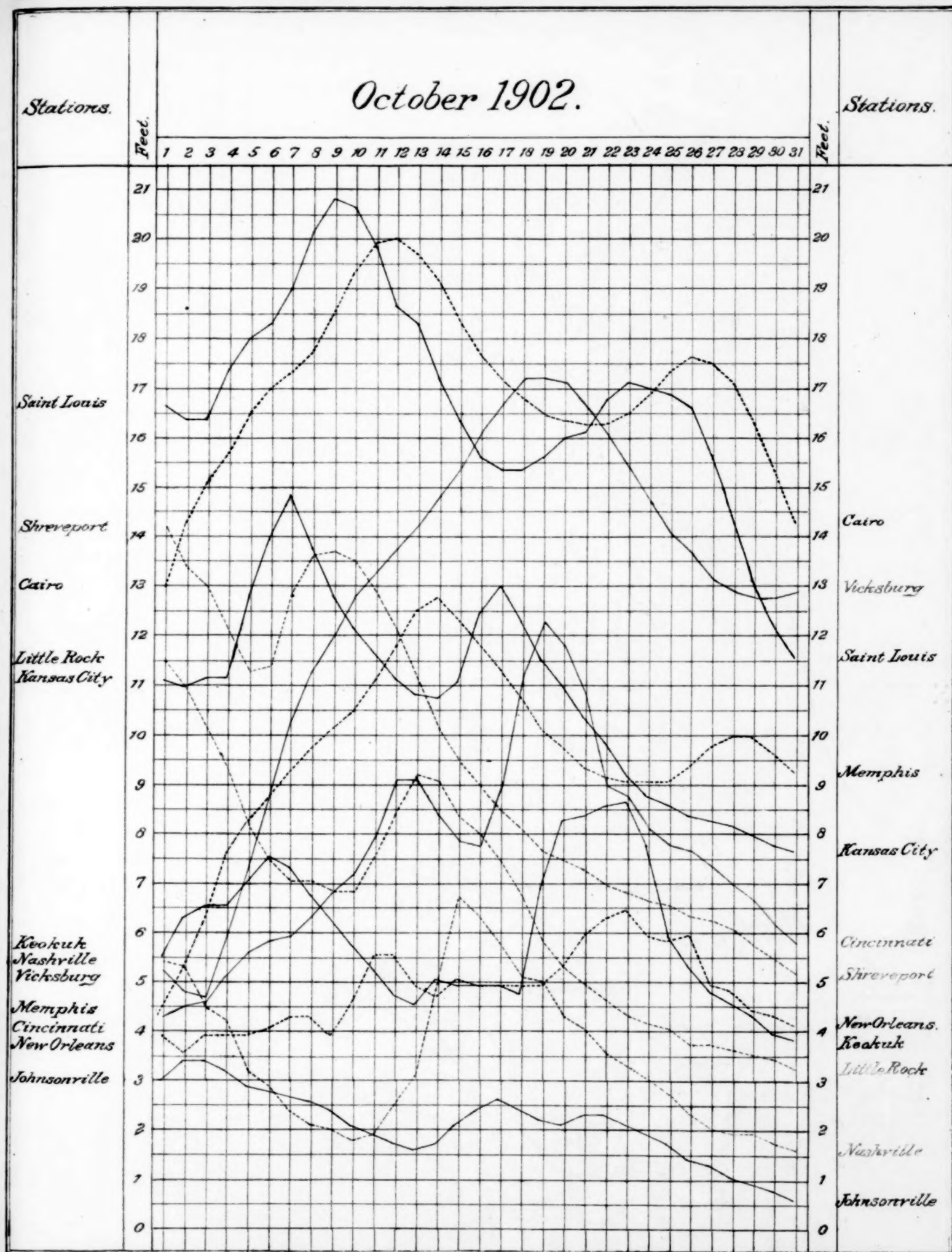


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. October, 1902.





• Barkerville
Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. October, 1902.

